

4760
#25 ZAC

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
SANFORD M. STEVENSON

Art Unit: 1724

RECEIVED

JAN 05 2004

OFFICE OF PETITIONS

Serial No.: 09/652,272

Examiner: P. Hruskoci

Filed: August 31, 2000

Before: Fred A. Silverberg
Office of Patent Legal Administration

For: METHOD FOR REMOVING
METAL COMPOUNDS FROM
WASTE WATER

December 24, 2003

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO REQUIREMENT FOR INFORMATION

Sir:

In response to the Requirement for Information mailed November 24, 2003, applicant provides the following information.

On November 9, 2001, applicant mailed a Response to Petition to Institute Public Use Proceeding Pursuant to 37 C.F.R. 1.292 and Public Protest Pursuant to 37 C.F.R. 1.291 (hereinafter the "Response") (22 pages). Another copy of this Response is attached hereto.

Applicant also intended to attach to the Response Exhibits 1-16 (108 pages), a copy of the Accuscan, Inc. v. Xerox Corporation, 2001 U.S. App. LEXIS 11534 decision (7 pages), a certificate of service (1 page), and a request for extension of time (1 page). Applicant believes that these additional exhibits and other documents were also mailed to the U.S. Patent and Trademark Office (hereinafter the "Office") with the Response. In the event, however, that any of these numerically designated exhibits or other documents did not reach the Office, another

copy of each of these Exhibits 1-16 and the other documents are also attached hereto. A copy of the return receipt post card (1 page) for the original Response is also attached.

In the Response, applicant also referred to a number of the exhibits to the Petition to Institute Public Use Proceeding Pursuant to 37 C.F.R. 1.292 (hereinafter the "Petition") on pages 11-12 of the Response. These exhibits were Exhibits B, E, F, and G of the Petition. On the last line of page 1 of the Response, applicant requests that the word "numerical" be changed to "letter" so that the sentence bridging pages 1 and 2 of the Response should read as follows: "References to letter exhibits herein should be understood to mean the exhibits attached to the Petition under 37 C.F.R. 1.292." Applicant apologizes to the Office for any confusion caused by this previous misstatement, although it is pointed out that on page 11, line 15 of the Response it is stated that Exhibits B, E, F, and G were the Petitioner's exhibits. Although applicant does not believe that Exhibits B, E, F, and G were provided with the original Response since they had already been provided in the Petition, applicant now attaches a copy of these Exhibits B, E, F, and G (33 pages) for the convenience of the Office.

To update the status of the Chemical Separation Technology v. United States litigation, applicant has provided the undersigned with the attached Order (1 page) which updates the current status of this litigation. (The undersigned again points out that he is not representing applicant in this litigation.) Another decision relevant to this litigation at 63 U.S.P.Q 2d 1114 (25 pages) is also attached. The last date of February 16, 2003 on the attached Order has been docketed, and another status update will be promptly provided to the Office thereafter.

Applicant believes that the foregoing fully complies with the Requirement for Information. If any other matters are still believed to be at issue, the Office is urged to contact the undersigned.

copy of each of these Exhibits 1-16 and the other documents are also attached hereto. A copy of the return receipt post card (1 page) for the original Response is also attached.

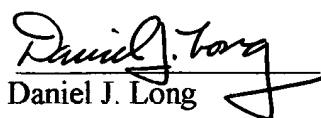
In the Response, applicant also referred to a number of the exhibits to the Petition to Institute Public Use Proceeding Pursuant to 37 C.F.R. 1.292 (hereinafter the "Petition") on pages 11-12 of the Response. These exhibits were Exhibits B, E, F, and G of the Petition. On the last line of page 1 of the Response, applicant requests that the word "numerical" be changed to "letter" so that the sentence bridging pages 1 and 2 of the Response should read as follows: "References to letter exhibits herein should be understood to mean the exhibits attached to the Petition under 37 C.F.R. 1.292." Applicant apologizes to the Office for any confusion caused by this previous misstatement, although it is pointed out that on page 11, line 15 of the Response it is stated that Exhibits B, E, F, and G were the Petitioner's exhibits. Although applicant does not believe that Exhibits B, E, F, and G were provided with the original Response since they had already been provided in the Petition, applicant now attaches a copy of these Exhibits B, E, F, and G (33 pages) for the convenience of the Office.

To update the status of the Chemical Separation Technology v. United States litigation, applicant has provided the undersigned with the attached Order (1 page) which updates the current status of this litigation. (The undersigned again points out that he is not representing applicant in this litigation.) Another decision relevant to this litigation at 63 U.S.P.Q 2d 1114 (25 pages) is also attached. The last date of February 16, 2003 on the attached Order has been docketed, and another status update will be promptly provided to the Office thereafter.

Applicant believes that the foregoing fully complies with the Requirement for Information. If any other matters are still believed to be at issue, the Office is urged to contact the undersigned.

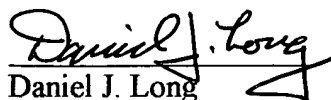
Applicant continues his request that action on this application be suspended under 37 C.F.R. 103(a) until the completion of the litigation. The reason for this request is that applicant is an independent inventor and has only limited resources to devote to this application. The cost of duplicating efforts which may already be underway in the litigation may be burdensome or may be a hardship for applicant.

Respectfully submitted,


Daniel J. Long

18 Rhodora Drive
Amherst, NH 03031
Telephone (603) 249-9317

This correspondence is being mailed by first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on December 24, 2003.


Daniel J. Long

Dec. 24, 2003
Date

Certificate of Service

This correspondence is being served on the following by first class mail on December 24, 2003.

Cameron Elliot
Commercial Litigation Branch
Civil Division
Department of Justice
Washington, D.C. 20530



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF :

SANFORD M. STEVENSON :

Art Unit 1724

SERIAL NO.: 09/652,272 :

Examiner: P. Hruskoci

FILED: September 17, 2001 :

FOR: METHOD FOR REMOVING
METAL COMPOUNDS FROM
WASTE WATER

Assistant Commissioner for Patents
Washington, DC 20231

#25
A. Hruskoci

**RESPONSE TO PETITION TO INSTITUTE PUBLIC USE PROCEEDING
PURSUANT TO 37 C.F.R. § 1.292 AND
PUBLIC PROTEST PURSUANT TO 37 C.F.R. § 1.291**

Introduction

Petitioner alleges that it filed the instant petitions pursuant to 37 C.F.R. §§ 1.292 and 1.291. In fact, Petitioner failed to file these Petitions under 37 C.F.R. §§ 1.292 and 1.291, because it was filed after the Notice of Allowance issued. Specifically, 37 C.F.R. §§ 1.292 and 1.291, require that for such petitions to be considered, they must be filed "prior to the date the application was published or the mailing of a notice of allowance under 37 C.F.R. § 1.311, whichever occurs first." Accordingly, these Petitions should be dismissed as untimely.

Even if the petition is not dismissed as untimely, it should be dismissed for the following reasons.

References to numerical exhibits herein should be understood to mean the exhibits

attached to the Petition under 37 C.F.R. § 1.292.

Second Prong of Pfaff and Alleged Public Use

The respondent herein, offers the following in response to the Petitioner's contentions. Notably, the basis of the Petitioner's contentions with respect to both the public use and on-sale bar lies with the reduction to practice of U.S. Patent No. 5,370,800 (hereafter the "'800 Patent"). ['800 Patent, Ex. 1] The '800 Patent, includes as part of Claim 1, the removal of copper. The present application, however, relates exclusively to the removal of copper. Petitioner alleges that the evidence submitted supports a *prima facie* showing that the '800 Patent, and therefore the instant application, were reduced to practice for the removal of copper more than a year prior to the instant application, a continuation of the '800 Patent's application, filed on May 25, 1993.

The instant Petitioner has been sued by the applicant and respondent herein in the Court of Federal Claims for infringement of the '800 Patent and another patent, U.S. Patent No. 4,749,497 to Kanzleiter, et al (hereafter the "'497 Patent"). [Ex. 13]. The evidence presented and made part of the record in a Markman hearing and validity trial establish that the invention claimed by the granted application belatedly attacked by petitioner was not reduced to practice for the removal of copper until August of 1992, less than a year prior to the instant application. Petitioner has not, and can not, produce any evidence to contradict this reality. Accordingly, the public use and on-sale bars which Petitioner urges invalidates the instant application, do not apply.

The evidence adduced in the Court of Claims establishes that prior to July or August

of 1992, applicant had not removed copper from a waste stream utilizing the method disclosed in either the '800 Patent or the instant granted application. [Ex. 2, Trial. Tr. 435:7-440:12; Ex. 3] It is further established that Mr. Stevenson, the patentee, engaged in significant experimentation in July and August of 1992, in order to reduce to practice his process as to the removal of copper. ***Chemical Separation Technology, Inc., v. U.S.***, 45 Fed. Cl. 513 (1999); [Ex. 2,3]

These facts contrast starkly with the Petitioner's representation that the Federal Court of Claims ruled that Mr. Stevenson's use was not experimental. The specific holding of the Federal Court of Claims is that the offer for sale was not an offer for an experimental process. The Court of Claims specifically held, however, that material issues of fact existed, precluding the entry of summary judgement, as to whether the invention was reduced to practice or remained experimental, prior to May 1993. ***Chemical Separation Technology, Inc., v. U.S.***, 45 Fed. Cl. 513, Fn. 10 (1999). Petitioner's interpretation to the contrary is clearly incorrect. The Court noted in its opinion that "it is unclear from the record how critical the polymer chemistry was to the success of the patented method and, if critical, when that chemistry was patentable." The Court further noted, "Moreover, a material dispute exists as to whether the work done by Mr. Stevenson in the weeks leading up to August 5, 1992, was experimentation going to the core of the patent or merely fine tuning." On the basis of these holdings, the Court denied the instant Petitioner's Motion for Summary Judgement.

In its opinion with respect to the '800 Patent, the Federal Court of Claims found the following facts to be established.

1. U.S. Patent No. 5,379,800 (the '800 Patent) was applied for on May 25, 1993, and granted on December 6, 1994;
2. On April 14, 1992, CST made a formal offer of sale of a waste water treatment facility using the PIT System to Summitville Consolidated Mining company (Summitville), to remove copper from waste water produced at its gold mine in Summitville, Colorado;
3. The offer was accepted on April 24, 1992, and a purchase order was signed by an agent of Summitville on May 5, 1992;
4. Following installation of the PIT System at Summitville, on August 31, 1992, Penny McPherson, the environmental manager at Summitville Mine, wrote to the United States Dept of Natural Resources and the Colorado Department of Health and advised them that a number of different polymers were utilized, that some were not compatible, and that it took some time to find polymer that was compatible with the PIT System.

C ST v. U.S., 45 Fed. Cl. 513 (1999)

Petitioner misinterprets the court's findings and contends that the instant application, like the '800 Patent, was ready for patenting prior to the critical dates for the public use and on-sale bars. In essence, Petitioner's arguments are a house of cards founded upon a misunderstanding of the Court of Claims' holding with respect to the '800 Patent. For this reason, Petitioner has utterly failed to set forth a prima facie showing of public use, or application of the on-sale bar.

Nothing in the prior art, prior commercial offer, or alleged public use shows that copper was removed such that the instant application was invalidated by such alleged prior art, public use or offer for sale. Instead, Petitioner attempts to confuse the issue by discussing non-ferrous metals and analogizing to copper. Petitioner has not, and cannot, point to any evidence which shows that copper, the metal of concern in the instant granted application, was removed prior to the critical date. Accordingly, Petitioner has failed to make out a prima facie showing that there was a public use, or sale of the invention

claimed in the present application it attempts to attack.

Indeed, Dr. Roth, Mr. Stevenson's trial expert, testified that prior to actually removing copper from a waste stream utilizing the method ultimately disclosed in the '800 Patent, it would not have been predictable with confidence to one skilled in the art that the entire process, the complete invention, would work for copper. [Ex. 4, Trial Tr. Pg. 609: 11-18] It was uncontradicted at trial that it would not have been predictable with confidence to one skilled at the art that utilization of the method disclosed by the '800 Patent would adequately treat a waste stream whose primary constituent is copper. Dr. Roth testified upon cross examination:

- Q: Dr. Roth, in your opinion, prior to actually removing copper from a waste stream with the method and apparatus of the 800 Patent, one skilled in the art would not have been able to predict with confidence that the invention claimed in - inventions claimed in the 800 Patent would be able to remove copper. Is that right?
- A: That is correct. There was no - I found no evidence in the literature to support that it would.

[Ex. 4]

Petitioner did not provide any evidence at trial to contradict this statement. Indeed, Petitioner attempted to discredit Dr. Roth by arguing that as a general matter, copper can be precipitated from a waste stream by mere adjustment of pH. However, Defendant fails to acknowledge that the '800 Patent, and the present application at issue, discloses more than the mere adjustment of pH. They also disclose oxidation and agitation, with the additional steps of flocculation accomplished with cationic and anionic polymers. Dr. Roth's testimony establishes that the '800 Patent, as claimed, was not reduced to practice until Mr. Stevenson had actually installed the PITS, and removed copper, which occurred

no earlier than July of 1992, two full months after the critical date of May 25, 1992.

In order for a chemical process such as the method of the granted application at issue to be patentable, the inventor has to reduce the method to practice to achieve a sufficient degree of predictability to determine if the invention would work for its intended purpose. *National Chemical Corp. v. Wright*, 458 F. Supp. 828, 839, 192 USPQ 95, 105 (M.D. Fla. 1976), *affd* 584 F2d 714, 200 USPQ 257 (5th Cir. 1978).

The holding in *Pfaff v. Wells Electronics, Inc.*, 525 U.S. ___, 142 L. Ed. 3d 261, 119 S. Ct. 304, 48 USPQ 2d 1641 (1998) continues to recognize the experimental exception to the on sale bar to patentability. *Pfaff*, at 311.

As it would not have been predictable to one skilled in the art that copper, as a primary constituent of a waste stream, could be removed effectively by utilizing the method disclosed in the granted application, until Mr. Stevenson achieved that result in August of 1992, his invention was not reduced to practice, and is therefore not invalid under the public use or on-sale bar.

Accordingly, Petitioner has failed to offer any evidence that the method of the present application, was reduced to practice prior to May 25, 1992.

It is also noted that Dr. R  th's opinion is corroborated by Power Engineers, a company that purchased CST and reviewed, under terms of confidentiality, the experimental process in use in Pennsylvania. In its technology review of the '497 Patent and related processes existing as of May 1990, which had only removed iron and minor amounts of manganese, Power acknowledged:

One area of concern is the fact that the existing operating systems have been used to remove only iron and manganese from waste streams. Although it is probable that removal of other heavy metals would occur, to determine actual removal efficiencies would require application of the CST systems to waste streams bearing other heavy metal constituents.

[Ex. 4, p. 3]

Further comments concerning the above are in Paragraph 7 of applicant's declaration [Ex. 16]. In particular, these comments may primarily apply to the '497 patent.

It was not until July or August 1992 that the process to remove copper was reduced to practice.

Prior to actually removing copper from a waste stream, the invention ultimately claimed in the present application was neither reduced to practice, nor ready for patenting. Because removal of copper using this process was not reasonably predictable, prior to actually removing copper, applicant could not have claimed the removal of copper because he could not have know if the process was enabled, and had utility, both of which are required for grant of a patent. In order for a chemical process such as the method of the '800 Patent to be patentable, the inventor has to reduce the method to practice to achieve a sufficient degree of predictability to determine if the invention would work for its intended purpose. *National Chemical Corp. v. Wright*, 458 F. Supp. 828, 839, 192 USPQ 95, 105 (M.D. Fla. 1976), *affd* 584 F.2d 714, 200 USPQ 257 (5th Cir. 1978); see also *In re Borkowski*, 422 F.2d 904 (CCPA 1970) (a claim on an oxygenation process for hydrocarbons was held invalid. One major species of hydrocarbons had been tested and the results of that test were disclosed in the patent. Because, however, another major species of hydrocarbons was not tested as disclosed, the claim was held invalid for undue

breadth.)

"Obvious to try" has consistently been rejected as an appropriate test of obviousness. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5USPQ 2d 1434 (Fed. Cir. 1988) cert. denied, 488 U.S. 825 (1988), on remand, 13 USPQ 2d 1172 (D. Conn. 1989); *In re Geiger*, 815 F.2d 686, 2 USPQ 2d 1276 (Fed. Cir. 1987). *N.V. Akzo v. E.I. DuPont de Nemours & Co.*, 810 F.2d 1148 USPQ 2d 1704 (Fed. Cir. 1987); *Novo Industri Als v. Travenal Industries, Inc.*, 677 F.2d 1202, 215 USPQ 412 (7th Cir 1982); *In re Dien*, 371 F.2d 886, 152 USPQ 550 (CCPA 1967).

"Courts have long disfavored the argument that an infringed patent represented no advance over prior art. Obviousness must be established by consideration of the prior art, as well as the claimed invention as a whole. The reference must do more than suggest that an innovation 'ought to be tried,' or is obvious in hindsight; it must directly suggest the desirability of the new combination." *Polaroid Corp. Eastman Kodak Co.*, 641 F. Supp 828, 853, 288 USPQ 305, 324 (D. Mass. 1985) affd 789 F.2d OJ6, 229 561 (Fed. Cir. 1986), cert denied, 479 U.S. 850 (1986).

Accordingly, the '800 Patent and the present application, both of which claim copper removal, were not reduced to practice until July or August of 1992, two months subsequent to the public use and on-sale bar date.

Petitioner contends that the Keystone Plant, which only removed predominantly iron and minor amounts of manganese and aluminum from a waste stream, was successfully used prior to the critical date, and therefore, amounts to a reduction to practice and public use of the granted application at issue prior to the critical date. Petitioner also identifies

a business plan used internally and correspondence by applicant to support its' contention that copper was removed prior to the critical date.

With respect to the first contention, even assuming the Keystone Plant was publicly used, Petitioner fails to acknowledge that the invention claimed in the present application which Petitioner belatedly attacks teaches a method for removing copper. The Keystone Plant can not inherently be the same method as the present application, because it was never used to remove copper. The Keystone Plant only removed iron along with manganese and aluminum, which is not the subject of claim 7. Because it was not known prior to actual reduction to practice if the process would work for copper, the Keystone Plant can not literally or inherently anticipate the granted application. ***Scaletech Inc., v. Retec/Tetra, L.L.C.***, 178 F.3d 1378, 1384 51 USPQ 2d 1055, 1058 (Fed. Cir. 1999).

Accordingly, the Keystone Plant can not constitute a public use of the granted application because it is not the complete invention disclosed by the granted application. A "public use" for the purpose of barring access to the patent system is a use more than a year before the patent filing date, whereby a completed invention is used in public, without restriction and in circumstances other than "substantially for the purposes of experiment." ***Allied Colloids Inc., v. American Cyanamid Co.***, 64 F.3d 1570, 1574 (Fed. Cir. 1995).

Equally important, however, is the fact that the use of the Keystone Plant was not a "public use" but was experimental in nature as evidenced by the contracts with Pennsylvania Electric. [Ex. 6] As stated in ***Smith & Griggs Mfg. Co., v. Sprague***, 123 U.S. 249, 256, 31 L.Ed. 141 8 S. Ct. 122 (1887):

A "public use" for the purpose of barring access to the patent system is a use more than one year before the patent filing date, whereby a completed invention is used in public, without restriction and in circumstances other than "substantially for the purposes of experiment".

The record in the trial before the Federal Court of Claims established that when anyone viewed the Keystone Plant operated by Chemical Separation Technology (CST), they were under a confidentiality agreement. [Ex. 7 page 56, lines 23-25, page 57, line 1, November 13, 2000], that when they viewed the apparatus that was ultimately disclosed in the '800 Patent, all elements with the exception for the '497 Patent reactor and the caustic tank were enclosed within a building and hidden from view. [Ex. 8 page 105, lines 17-20]; that the experimental de-watering apparatus at the Keystone Plant was enclosed within a secure building and hidden from sight. [Ex. 9 page 344 lines 19-25, page 345, lines 1-6, and page 392, lines 7-8]; that the contract that CST had with Penelec at the Keystone Plant was a research and development contract. [Ex. 11 page 393, lines 18-25, page 394, lines 1-14, and page 395, lines 11-15 November 6, 2000 transcript. Also see exhibit 5]; and that the work on the de-watering apparatus at the Keystone Plant was experimental, and considered by CST to be their laboratory where they would experiment and develop what was ultimately disclosed in the '800 Patent [Ex. 12 page 394, lines 10-14 November 16, 2000].

In Allied Colloids Inc., v. American Cyanamid Co., 64 F.3d 1570, 1574;

35 U.S.P.Q. 2D (BNA) 1840 (Fed. Cir. 1995) the Federal Circuit held as follows:

The law recognizes that the inventor may test the invention, in public if that is reasonably appropriate to the invention, without incurring a public use bar. *In City of Elizabeth v. American Nicholson Pavement Co.*, 97 U.S. 126, 24 L.Ed. 1000 (1878) (distinguishing "public use or sale") the Court wrote:

When the subject of the invention is a machine, it may be tested and tried in a building, either with or without closed doors. In either case, such use is not a public use, within the meaning of the statute, so long as the inventor engaged, in good faith, in testing its operation. He may see cause to alter and improve it, or not. His experiments will reveal the fact whether any and what alterations may be necessary. 97 U.S. at 134 - 135.

The evidence establishes that CST and Mr. Stevenson were engaged in experimentation throughout their work at the Keystone Plant. The contract between Pennelec and CST memorializes this fact. [Ex. 5 Joint Exhibit 66]. The site was remote, secure, and those who viewed the site did so under terms of confidentiality. Most importantly the invention that was ultimately disclosed in the '800 Patent and the present granted application was never reduced to practice until some months subsequent to the bar date when Mr. Stevenson successfully installed the PITS at Summitville, and actually removed copper.

With respect to Petitioner's reliance upon its Exhibits B, E, F, and G, Petitioner did not disclose the following and applicant wishes to make the facts clear.

With respect to Exhibit B, it is a letter memorializing the effluent quality sought to be achieved at the Summitville mine site by Summitville Consolidated Mining Company.

Exhibit E, again, is a letter memorializing the water quality sought to be treated by CST's treatment process.

Exhibit, F, again, is a letter memorializing desired metal recovery from the site.

Exhibits, B, E, and F, do not establish that copper was removed prior to the critical date. Rather, they demonstrate that copper was sought to be removed.

It was on the basis of these documents, offered by Petitioner in the Court of Claims

in support of its motion for summary judgement which the Court denied, that the court concluded that the **OFFER** was a commercial offer rather than an offer of an experimental process. Because no proof was shown that the process had ever removed copper prior to the critical date, material issues of fact existed with respect to when the invention claimed in the '800 Patent, and therefore the present application, was reduced to practice. Petitioner's representation that these exhibits demonstrate that the invention claimed in the present application was reduced to practice prior to the critical date is, therefore, incorrect.

With respect to Exhibit G, Petitioner's attempt to characterize the Business Plan as proof that the process was reduced to practice is also misguided. First the business plan speaks of removal of copper as a "trace metal", not as a primary constituent of concern [Petitioner's Exhibit G, page 17]. Secondly, the Business Plan was a prospectus, with forward looking statements, that was shared only under terms of confidentiality. [Petitioner's Exhibit G, page 5]. Ultimately, as corroborated by the actual treatment summary on page 17 of Exhibit G, Petitioner can not, and has not, offered any evidence to show that the granted application was reduced to practice prior to the critical date because it can not show that it actually removed copper.

In *City of Elizabeth v. the American Nicholson Pavement Co.* 97 U.S. 126, 24 L.Ed. 1000 (1877) a patent on pavement for roads, the Patentee (Nicholson) had laid down 75 feet of the pavement on a toll road that was open to the public but owned by a company of which he was a shareholder and officer. The road was used constantly for the six year period prior to Nicholson's application for a patent. Nicholson constructed the road to test its durability under the stress of heavily loaded wagons, constant use, and general weather

conditions and he regularly inspected the road. The pavement was put down at Nicholson's expense. The court held as follows that such an experimental use to test the invention's qualities was not a "public use" within the meaning of the statute even though it was a use in public.

"That the use of the pavement in question was public in one sense cannot be disputed. But can it be said that the invention was in public use? The use of an invention by the inventor himself, or of any other person under his direction by way of an experiment, and in order to bring the invention to perfection, has never been regarded as such a use."

In *Pfaff v. Wells Electronics Inc.* 119 S. Ct. 304, 310, 48 USPQ 2d 1641, 1645 (1998) the Court cited *City of Elizabeth* and noted as follows:

"[A]n inventor who seeks to perfect his discovery may conduct extensive testing without losing his right to obtain a patent for his invention - even if such testing occurs in the public eye. The law has long recognized the distinction between inventions put to experimental use and product sold commercially."

In *Manville Sales Corp. v. Paramount Systems, Inc.* 917 F.2d 544, 16 USPQ 2d 1587 (Fed. Cir. 1990) the patent related to a self-centering luminaire assembly for traveling up and down poles such as tall out door lighting fixtures. Manville, who was the assignee obtained a subcontract to supply a lighting pole at a Wyoming highway rest stop. It installed a pole which failed. It then developed a self-centering luminaire design with "iris" guide arms. The design was installed on a test-pole at Manville's research center. It then obtained permission to substitute the new design at the rest stop. It then sent the official a drawing, which contained a confidentiality notice. It then installed the device. It then applied his new design to poles so that the iris design could be included. Manville approved the iris arms for commercial use and then verified that the iris arm worked even

after the severe Wyoming winter.

Wyoming officials inspected the arm and approved payment and within a year of such approval Manville filed a patent application on the invention. The Federal Circuit affirmed the district court's finding of no public use bar.

"[M]anville's actions are entirely consistent with the policy "favoring prompt and widespread disclosure of inventions. This iris arm device was specifically designed to withstand year around weather. Prior to its testing in the winter environment, there really was no basis for confidence by the inventor that the invention would perform as intended, and hence no proven intention to disclose. **See Gould Inc. v. United States**, 579 F.2d 571, 583, 198 USPQ 156, 167 (Ct. Cl. 1978) (period of experimental use continues until after the inventor "conducts tests needed to convince himself that he invention is capable of performing its intended purpose in its intended environment"). The Evidence indicates, moreover, that once the outdoor tests were complete, and the invention was found to work as intended, Manville acted within the statutorily prescribed period in disclosing the invention, once tested, to the public" USPQ 2d Ct. 1592.

In **Allied Colloids Inc. v. American Cyanamid Co.**, it was held that on a patent on polymer sewage treatment compositions and methods, that experimental use at a potential customer's facility were necessary because "the biological nature of sewage varies "and the results of laboratory testing did not guarantee the same result with testing in sites."

In **Seal-Flex, Inc. v. Athletic Track and Court Construction** 98 F.3d 1318, 1323, 40 USPQ 2d 1450, 1453 (Fed. Cir. 1996) further appeal 172 F.3d 836, 50 USPQ 3d 1225 (Fed. Cir. 1999) a period of over a year was allowed as experimental use for a patentee to determine if a running track would perform under actual conditions of weather and use.

The Federal Circuit also restated as follows factors to be considered as follows:

In **Baker Oil Tools, Inc. v. Geo Vann, Inc.**, 828 F.2d 1558, 1564, 4 USPQ2d 1210, 1214 (Fed. Cir. 1987), the court summarized various criteria that may be relevant to the determination of whether an invention had been completed and shown to work for its intended purpose at the time of a possible public use or on sale event.

These criteria include the facts of whether the tests or evaluation that were conducted were reasonably needed to demonstrate the efficacy of the invention; the length of the evaluation period in relation to the nature of the invention; whether testing was systematically performed; whether the evaluation was done by or on behalf of the inventor; whether records were kept; whether payment was received; and other circumstances that illuminate the nature of the activity engaged in before the critical date."

THE INGLIS REFERENCE

The present invention is neither taught or suggested by U.S. Patent No. 4,652,381 Inglis (hereafter "Inglis").

1. The present invention is not anticipated by Inglis.

There is absolutely nothing in Inglis which teaches the process ranges recited in claim 7.

Agitating the waste water, where steps (a) (b) and (c) are carried out simultaneously in a reaction tank where waste water is aerated in said reaction tank to provide a dissolved oxygen concentration at from about 0.01 lb./hr. to about 70 lbs./hr. at a waste water input flow rate of from about 50 gal./min. To about 500 gal./min. for a copper metals concentration of from about 50 mg./l. To about 1,000 mg./l.

In fact, Petitioner completely misinterprets the Court's construction of similar language in the '800 Patent. The court's holding, in context, certainly does not support Petitioner's position that this language was not intended as a limitation on the patent. The entire pertinent portion of this holding reads as follows.

The next portion of Claim 1 to be construed involves that portion of Claim 1 stating, "Aerated and said reaction tank to provide a dissolved oxygen concentration at from about 0.01 pounds per hour to about 70 pounds hour." I also want to construe in conjunction with that portion of Claim 1 that deals with "about 50 gallons per minute to about 500 gallons per minute and about 50 milligrams per liter to about 1,000

milligrams per liter."

Based upon the consideration of the language, based upon the expert testimony in particular, and so this is one in which I am relying on extrinsic evidence, I determined that this refers to a rate of aeration, and that the limitations -- excuse me -- that the ranges expressed in terms of "50 gallons per minute to about 500 gallons per minute and about 50 milligrams per liter to about 1,000 milligrams per liter" are not intended as limitations on the patent. (emphasis added).

In other words, it was determined that this language defined aeration rates for any particular flow rates, not that it defined no limitations at all.

2. The present invention is not obvious in view of Inglis.

Inglis teaches away from the method of the present invention in several important respects. For example, Inglis teaches the use of a second treatment tank (50) while in the method of the present invention aeration, agitation and neutralization take place in a single vessel. The preferred embodiment of Inglis discloses is a batch process while the method of the present invention is a continuous process. Inglis appears to be a relatively slow process, e.g. treatment tank 50 is preferable allowed to settle for 20 hours, while the method of the present invention is designed to be particularly fast. It is also pointed out that applicant's expert, Dr. Roth, testified that he calculated that to treat 500 gallons per minute of waste water with the Inglis system that it would be necessary to use an approximately 760,000 gallon treatment tank [Ex. 15, Trial. Tr. 584: 15 - 21]. Thus, the Inglis method teaches toward the use of a large, cumbersome and unwieldy water treatment unit which is entirely away from the results obtained with the method of the present invention.

FIRST PRONG OF PFAFF

1. Introduction

Although the cited Court of Claims opinion concluded that the defendants burden had been met with regard to the first prong of **Pfaff** (but not with respect to the second prong), Applicant respectfully requests that this conclusion be reconsidered in view of a number of recent decisions of the court of Appeals for the Federal Circuit. Although Applicant believes that it is not necessary to reach the first prong of **Pfaff** because the standards of the second prong of **Pfaff** have not been met. Applicant requests, however, the right to supplement the following with further related evidence and arguments should the same be necessary in the future

2. Group One Ltd. v. Hallmark Cards, Inc.

First, at the time of the court's decision, the issue of the nature of the type of offer required by the first prong of **Pfaff** was still open. See, for example, Katherine Kelly, Cases and Recent Developments / Patents, 8 Fed. Cir. B.J. 57, 74 (1999). ("Still open for debate is whether the 'subject of a commercial offer for sale' prong of **Pfaff** will be interpreted as requiring an offer of specific contractual terms, or whether it will be applied more broadly.")

This question has now been answered by the Federal Circuit to require such an offer to contain specific contractual terms. In **Group One Ltd. v. Hallmark Cards, Inc.** 254 F.3d 1041, 59 USPQ 2d 1121, 1126 (Fed. Cir. 2001) the first prong of **Pfaff** as follows was further interpreted as follows.

"Only an offer which rises to the level of a commercial offer for sale, one which the other party could make into a binding contract by simple acceptance (assuming consideration), constitutes an offer for sale under § 102(b)."

The Restatement of Contracts, 2d §33(1) provides as follows.

"Even though a manifestation of intention is intended to be understood as an offer, it cannot be accepted so as to form a contract unless the terms of the contract are reasonably certain."

Although the Uniform Commercial Code departs from the strictness of the common law by allowing an open price, it does not permit the court to read into a contract the price for a product that was not known and was not provided for by the contract and for which there is no evidence of any basis for determining a price. ***Coca-Cola Bottling Co. v. Coca-Cola Co.***, 988 F.2d 387 (3d Cir, 1993), cert denied 126 L. Ed 239, 114S. S. Ct. 289

In view of the above, the applicant believes that the letter of April 14, 1992 constituted only preliminary negotiations because, terms which would ordinarily be considered material, such as overall price for a unique, non-fungible product, were not included. Subsequently the purchase order contained a specific request for "plans and specifications". Applicant believes that such "plans" included a drawing of June 22, 1992 which was sent to the buyer. An offer which "the other party could make into a binding acceptance by simple acceptance" was not made, if at all, until June 22, 1992. As stated above, applicant request leave to supplement the above with additional evidence and arguments should the same be necessary.

3. *Accuscan, Inc. v. Xerox Corporation*

In ***Accuscan, Inc. v. Xerox Corporation***, 2001 U.S. App. Lexis 11534, -24 (Fed. Cir. 2001) (copy attached), it was held that the subject of a commercial offer for sale must be something within the scope of the claim of the patent.

In this opinion the Federal Circuit cited its prior decision in **Scaltech v. Retec/Tetra L.L.C.**, 178 F.3d 1378, 1999, 51 USPQ 2d 1055, 1058 (Fed. Cir. 1999) a factual situation was considered which was similar to that of the present application.

In this case Scaltech was presented by a customer with a problem related to an inefficiency in process for producing petroleum coke which involved the introduction of a hydrocarbon feed stream. One of Scaltec's employee conceptualized that oils in the fluid stream might be plugging the coke pores in the coking units, thus causing the inefficiency. Scaltech sought access to a coker unit to test this theory in which solids contents in the waste stream would be controlled. It proposed trying this process to a number of refineries, but the proposal contained nothing concerning particle size or solids concentration. Scaltech subsequently obtained a patent in which the claims had a number of specific process limitations, i.e. a liquid stream with 5 - 35% by weight solids, less than 6% by weight organics with a particle size distribution such that there was more than 70% by weight having a particle size less than 15 microns.

Under these circumstances the Federal Circuit held that the first prong of **Pfaff** must be based on an offer for sale of a process within the scope of the patent claims. That is, the process which was being sold, would have had to contemplate the process conditions at the time of the offer. Part of the Federal Circuit's opinion is as follows.

"The "invention" which has been offered for sale must, of course, be something within the scope of the claim. **See Graver Tank & Mfg. Co. v. Linde Air Prods. Co.**, 339 U.S. 605, 607 [85 USPQ 328] (1950) (a claim in a patent provides the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using, or selling the protected invention). Hence, the first determination in the § 102 (b) analysis must be whether the subject of the barring activity met each of the limitations of the claim, and thus was an embodiment of the

claimed invention. In this case, claim 6, set forth above, is the broadest claim. It specifically requires that the "delayed coker quench stream [contain] ... about 5 to about 35% by weight solids ... less than about 6% by weight mobile organics [and the solids] ... having a particle size distribution such that greater than about 70% of the total solids volume comprises solids having a particle size of less than about 15 microns." The record does not indicate whether an embodiment of the claimed invention was offered for sale. The district court did not address whether the process that was offered in the 30 March 1998 proposal to chevron or the 15 November 1988 proposal to Champlin would necessarily have satisfied the claim limitations relating to small particle size and high solids concentration.

We note that there is no requirement that the offer specifically identify these limitations. *See, e.g., RCA Corp. v. Data General Corp.*, 887 F.2d 1056, 1060, 12 USPQ2d 1449 (Fed. Cir. 1989); *Sonoscan, Inc. v. Sonotek, Inc.*, 936 F.2d 1261, 1263, 19 USPQ2d 1156, 1158 (Fed. Cir. 1991). Nor is there a requirement that Scaltech must have recognized the significance of these limitations at the time of offer. *See Titanium Metals Corp. v. Banner*, 778 F.2d 775, 780, 227 USPQ 773, 777-78 (Fed. Cir. 1985); *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 633, 2 USPQ2d 1051, 1054 (Fed. Cir. 1987). If the process that was offered for sale inherently possessed each of the claim limitation, then the process was on sale, whether or not the seller recognized that his process possessed the claimed characteristics. *See In re King*, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986).

Inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient to establish inherence. *See Continental Can Co. v. Monsanto Co.* 948 F.2d 1264, 1269, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). However, if the natural result flowing from the operation of the process offered for sale would necessarily result in achievement of each of the claim limitations, then claimed invention was offered for sale. *See id.*

The district court must determine if the process offered for sale, in its normal use, inherently satisfies each claim limitation. If so, then the offer creates a §102 (b) bar. The district court did not perform this analysis. Therefore, we vacate the district court's holding and remand for a determination as to whether the process on sale inherently satisfies each claim limitation. 47 USPQ 2d at 1052 - 1053 (emphasis added).

Referring to the applicant's Declaration [Ex. 16], it is quite clear that method recited in claim 7 which also included specific process conditions is not inherent in the use of the apparatus contemplated by the alleged offer of sale. Such apparatus can be operated so

that the rate of aeration and other process conditions are either inside these process conditions or outside of these process conditions. Certainly the method would not invariably be inside these range of process conditions.

With regard to inherence it was held in *Gubelmann v. Gang*, 408 F.2d 758, 766, 161 USPQ 216, 222 (CCPA 1969)...it is not sufficient that a person following might obtain the result set forth in the [claim]; it must invariably happen." In fact, at the time of the alleged offer for sale, applicant states in his Declaration that he had no idea of what process conditions because he was for the first time dealing with a predominantly copper contaminated stream and the treatment site was at an elevation of over 11,000 feet.

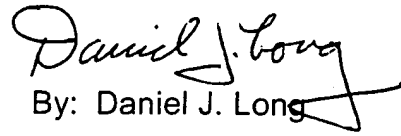
**CONCLUSION AND, IN THE ALTERNATIVE, PETITION FOR SUSPENSION
OF ACTION UNDER 37 C.F.R. § 103 (a)**

For the above reasons, applicant contends that the Petitions under 37 CFR §§ 1.292 and 1.291 should be dismissed.

In the alternative, if these Petitions under 37 CFR §§ 1.292 and 1.291 are not dismissed, applicant requests that action on the present application be suspended under 37 CFR § 103 (a) until the conclusion of his litigation. The reason for this request is that applicant is an independent inventor and only limited resources to devote to this application. The cost of a duplication of fact finding on matters which may already have been addressed in applicant's litigation would be burdensome or would be a hardship for applicant. A check for the \$130.00 fee due for this petition under 37 CFR § 1.17 (h) is enclosed.

Respectfully submitted,

SAND & SEBOLT


By: Daniel J. Long

DJL/klh



respectfully submitted at Canton, Ohio this 9th day of November, 2001.

SAND & SEBOLT

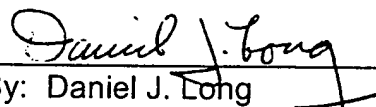
By: Daniel J. Long
Reg. No. 29,404

Aegis Tower
Suite 1100
4940 Munson Street N.W.
Canton, Ohio 44718-3615
Telephone: (330) 244-1174
Facsimile: (330) 244-1173
DJL/klh



CERTIFICATE OF SERVICE

In accordance with 37 CFR § 1.292 (a)(4) this response is being served by first class mail on Susan L. Christenberry, Esq. and Louis A. Tarasi, Jr., Esq. on November 9, 2001.


By: Daniel J. Long



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: S. Stevenson

Serial No: 09/652,272

Examiner: Hruskoci, P.

Filed: August 30, 2000

Art Unit: 1724

For: METHOD AND APPARATUS FOR REMOVING METAL COMPOUNDS FROM
WASTE WATER

Assistant Commissioner for Patents
Washington, D.C. 20231

REQUEST FOR EXTENSION OF TIME

Dear sir:

Further to applicant's request of October 26, 2001, applicant requests an additional seven day extension of time until November 9, 2001 to file this response since applicant had recently been traveling and needed additional time to review and sign a declaration which was part of his response.

NO. 058 ✓

Inventor/Applicant: S.M. STEVENSON

Title: INTERNAL APPROPRIATION FOR RESEARCH

Attorney Docket No. 013-1-00-01-01 Initials SM

Pat. No.: never issued

Ser. No.: 01162 272

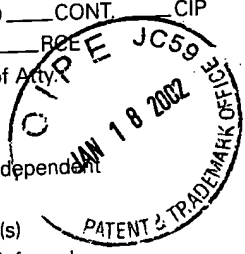
Filed: 8-31-00

Date: 11-9-01

☐ **PATENT/DESIGN APPLICATION**

___ UTIL ___ PRO ___ CONT. CIP
___ DIV ___ PCT ___ BCE

___ Declaration/Power of Atty.
___ Pages Specification
___ Pages Claims
 ___ total ___ independent
___ Pages Abstract
___ Sheet(s) of drawing(s)
 ___ formal ___ informal
___ Preliminary Amendment



☐ **APPLICATION DATA SHEET**

☐ **PCT REQUEST**

☐ **CHECK(S) in Amount \$** 132.00

☐ **AMENDMENT (Due _____)**
 ___ Ext. of Time for ___ Month(s)

☐ **ISSUE FEE**

☐ **TRANSMITTAL**

___ New Application ___ Amendment
___ Assignment ___ Issue Fee
___ Fees ___ General

☐ **CERTIFICATE OF MAILING**
☐ **EXPRESS MAIL NO.**

☒ **OTHER**

REQUEST FOR EXT.
PREPARE TO PRINT
PRINT OF DISCLOSURE

RECEIPT IS HEREBY ACKNOWLEDGED

ACCUSCAN, INC., Plaintiff-Cross Appellant, v. XEROX CORPORATION, Defendant-Appellant.
00-1316, 00-1320, 00-1406

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT
2001 U.S. App. LEXIS 11534

May 31, 2001, Decided

NOTICE:

[*1] RULES OF THE FEDERAL CIRCUIT COURT OF APPEALS MAY LIMIT CITATION TO UNPUBLISHED OPINIONS. PLEASE REFER TO THE RULES OF THE UNITED STATES COURT OF APPEALS FOR THIS CIRCUIT.

SUBSEQUENT HISTORY: Rehearing and Rehearing En Banc Denied July 3, 2001, Reported at: 2001 U.S. App. LEXIS 16640.

DISPOSITION: District court's denial of Xerox's motion for JMOL of noninfringement reversed. District court's denial of Xerox's motion for JMOL of invalidity pursuant to 35 U.S.C. § 102(b) affirmed. Ruling regarding noninfringement renders additional issues in case moot.

CASE SUMMARY

PROCEDURAL POSTURE: Defendant corporation appealed from the judgment of the United States District Court for the Southern District of New York, denying its motion for judgment as a matter of law and a new trial, and upholding a jury verdict of patent infringement in favor of plaintiff corporation in plaintiff's patent infringement action.

OVERVIEW: Plaintiff corporation brought a patent infringement action against defendant corporation regarding a photocopier scanning device. Following a jury trial, the district court entered a verdict of patent infringement in favor of plaintiff. The district court subsequently denied defendant's motion for judgment as a matter of law of noninfringement and a new trial, although the district court granted a new trial on the issue of damages. On appeal, the court reversed and remanded, holding that issues of claim construction and prosecution history estoppel precluded a finding of infringement by defendant. The court concluded that the district court improperly denied defendant's motion for judgment as a matter of law of noninfringement. However, the court further held that the district court

properly denied defendant's motion for judgment as a matter of law of invalidity pursuant to 35 U.S.C. § 102(b).

OUTCOME: Judgment was reversed and remanded.

CORE CONCEPTS -

JUDGES: Before CLEVENGER, Circuit Judge, PLAGER, Senior Circuit Judge, SCHALL, Circuit Judge.

OPINIONBY: CLEVENGER

OPINION:
CLEVENGER, Circuit Judge.

Xerox Corporation ("Xerox") appeals the post-verdict judgment of the United States District Court for the Southern District of New York upholding a jury verdict of patent infringement in favor of AccuScan, Inc. ("AccuScan"). The patent at issue in this appeal is U.S. Patent No. 3,952,144 ("the '144 patent"). Xerox also appeals the denial of its motion for judgment as a matter of law ("JMOL") of patent invalidity based upon anticipation and the on-sale bar pursuant to 35 U.S.C. § 102(b). Xerox additionally appeals the denial of its JMOL motion[*2] contesting the jury finding that AccuScan provided sufficient notice of infringement with regard to certain Xerox products, as well as the denial of Xerox's motion for a new trial pursuant to Fed. R. Civ. P. 60(b)(3).

On cross-appeal, AccuScan challenges the district court's denial of AccuScan's motion for JMOL requesting reversal of the jury's finding that Xerox did not willfully infringe. AccuScan also contests the district court's grant of a new trial on the issue of damages.

We conclude that issues of claim construction and prosecution history estoppel preclude a finding of infringement in this case. We therefore reverse the district

court's denial of JMOL of noninfringement. Because the issue of patent invalidity was raised as a counterclaim in this case, we must also address the validity rulings regarding anticipation and the on-sale bar. *Cardinal Chem. Co. v. Morton Int'l, Inc.*, 508 U.S. 83, 93-94, 124 L. Ed. 2d 1, 113 S. Ct. 1967 (1993); *Gen. Elec. Co. v. Nintendo Co., Ltd.*, 179 F.3d 1350, 1356, 50 USPQ2d 1910, 1914-15 (Fed. Cir. 1999). We affirm the district court's denial of JMOL of invalidity.

Our holdings moot the appeals regarding[*3] notice and the denial of a new trial, and also moot the cross-appeals regarding willfulness and the grant of a new trial regarding damages.

I

The '144 patent, entitled "Methods and Apparatus for Automatic Background and Contrast Control," is directed towards a circuit for performing contrast calibration for a scanned document. A document is typically scanned by repeatedly sweeping a light beam across it, while a photosensor senses the light reflected off the document and generates an electrical signal representing the amount of reflected light. Variations in this input signal indicate the black and white contrast within the document. However, undesirable variations in this signal may also be caused by factors such as the age of the equipment and temperature changes.

The '144 patent discloses a calibration circuit, referred to as an "ABC" circuit, that automatically corrects the input signal. The ABC circuit first scans a calibration strip on the relevant document, which contains known black and white samples, and stores the values of these samples as reference values for the entire document. The first reference value, taken from a black sample, is designated Vb, and the second reference[*4] value, taken from a white sample, is designated Vw. During subsequent scanning and transmission of the document, the ABC circuit receives a video input signal VIN representing the shade of intensity of darkness or lightness of the document area then being scanned. The ABC circuit calibrates the video input signal VIN using Vb and Vw to produce a corrected output signal VO, according to the equation (hereinafter, the "Kolker equation"):

$$VO = (VIN - Vb) / (Vw - Vb)$$

'144 patent, col. 4, line 63 - col. 5, line 2.

II

A jury verdict found that four of Xerox's product lines

infringed the '144 patent: 1) the DocuTech publishing system, 2) the 5775 color copier, 3) the SA4 scanner, and 4) the 7017/20/21 facsimile machines. The district court denied Xerox's subsequent request for JMOL of noninfringement for all four product lines. The denial of a motion for JMOL following a jury verdict is reviewed by reapplying the district court's standard of review. *Tec Air, Inc. v. Denso Mfg. Mich., Inc.*, 192 F.3d 1353, 1357, 52 USPQ2d 1294, 1296 (Fed. Cir. 1999). A district court may overturn a jury's verdict only if, upon the record before the jury, reasonable jurors could[*5] not have reached that verdict. *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 893, 221 USPQ 669, 673 (Fed. Cir. 1984).

On appeal, Xerox argues that when the asserted claims are properly construed as informed by the prosecution history, none of Xerox's products infringe, either literally or under the doctrine of equivalents. We review issues of law without deference, including issues of claim construction. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979, 34 USPQ2d 1321, 1329 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370, 134 L. Ed. 2d 577, 116 S. Ct. 1384 (1996). Whether prosecution history estoppel applies to preclude a patentee from regaining, through litigation, coverage of subject matter relinquished during prosecution, is also a question of law. *Wang Labs. Inc. v. Mitsubishi Elecs. Am., Inc.*, 103 F.3d 1571, 1577-78, 41 USPQ2d 1263, 1269 (Fed. Cir. 1997).

In construing the claims, we begin first by reviewing the intrinsic evidence, which consists of the claims, the written description, and the prosecution history. *DeMarini Sports, Inc. v. Worth, Inc.*, 239 F.3d 1314, 1323, 57 USPQ2d 1889, 1893 (Fed. Cir. 2001);[*6] *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582, 39 USPQ2d 1573, 1576-77 (Fed. Cir. 1996). Arguments and amendments made during the prosecution of the '144 patent limit the interpretation of the claim terms so as to exclude any interpretation that was disclaimed during prosecution. *Southwall Techs., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1576, 34 USPQ2d 1673, 1676-77 (Fed. Cir. 1995); *ZMI Corp. v. Cardiac Resuscitator Corp.*, 844 F.2d 1576, 1580, 6 USPQ2d 1557, 1561 (Fed. Cir. 1988).

Only claims 1 and 17 of the '144 patent are at issue in this litigation. Claim 1 is an apparatus claim that uses means-plus-function language:

1. Apparatus for processing a variable magnitude input signal representative of an input parameter which varies between predetermined first and second magni-

udes, said apparatus comprising:

A. means for storing a first sample of said input signal when said input parameter is at its first magnitude;

B. means for storing a second sample of said input signal when said input parameter is at its second magnitude;

C. and means, operable during a reception period in which said input signal [*7] is representing varying magnitudes of said input parameter, for continually combining said input signal and said first and second samples to continually produce an output signal representative of the difference in magnitude of said input signal and said first sample divided by the difference in magnitude of said first and second samples, whereby said output signal is normalized so as to represent the magnitude of said input parameter as a fraction of the range established by the difference in magnitude of said first and second samples.

'144 patent, col. 18, line 58 - col. 19, line 11 (emphases added to illustrate contested portions).

Claim 17 is a method claim:

17. A method for operating upon a variable magnitude signal representing a parameter which varies in magnitude over a range between a predetermined low magnitude and a predetermined high magnitude, said variable amplitude signal being subject to undesired offsets and gain variations in its representation of said parameter, said method comprising the steps of:

1. storing a first sample of said variable magnitude signal when said input parameter is at its low magnitude and producing a first signal representative [*8] of said stored first sample;

2. storing a second sample of said variable magnitude signal when said input parameter is at its high magnitude and producing a second signal representative of said stored second sample;

3. thereafter during a period in which said received input signals is [sic] representing the variable magnitude parameter, continually combining said input signal and said first signal to produce a first output signal having a magnitude representative of the difference in magnitude of said input signal and said first signal;

4. combining said first signal and said second signal to produce a second output signal having a magnitude representative of the difference in magnitude of said first

and second storage samples;

5. and combining said first and second output signals to produce a third output signal representative of the quotient of their magnitudes.

'144 patent, col. 22, lines 11-39 (emphases added to illustrate contested portions).

Xerox argues that statements made in the prosecution history to distinguish U.S. Patent No. 3,761,610 ("the Krallinger reference") limit the claims of the '144 patent in several ways. First, Xerox[*9] argues that AccuScan disclaimed the use of anything other than a "divide circuit" for the function claimed in claim 1 as: "producing an output signal representative of the difference in magnitude of said input signal and said first sample divided by the difference in magnitude of said first and second samples" (emphasis added). '144 patent, col. 19, lines 3-7. The portion of claim 17 corresponding to this "divide" function states: "producing a third output signal representative of the quotient of their magnitudes." '144 patent, col. 22, lines 29-32 (emphasis added).

The Examiner originally rejected all of the claims of the application that matured into the '144 patent pursuant to 35 U.S.C. § 103 as obvious over the Krallinger reference in view of U.S. Patent No. 2,909,597 ("the Johnson reference"). The prosecuting attorney replied to this rejection with remarks directed towards contrasting the invention of the '144 patent with the Krallinger and Johnson references. Because these remarks are not limited to any particular claim of the '144 patent, they are presumed to apply to all of the claims.

In distinguishing the '144 patent from the Krallinger reference, [*10] the prosecuting attorney stated:

In the further operation of the Krallinger, et al. device, during the scanning of the line the input video signal, background corrected by the black signal stored in capacitor 20, is multiplied [emphasis in original] by the temporarily fixed gain of the amplifier 24 throughout the remainder of the line so as to yield a background and gain compensated signal. It is clear, however, that a white sample is not stored or utilized during this operating period, and moreover, no divide circuit is utilized. . . (emphasis added).

The ABC circuit as disclosed in the '144 patent uses a "divide circuit 141" which "operates to divide the numerator signal by the denominator signal to continually produce a corresponding fully correct and gain controlled or normalized video output signal VO." '144

patent, col. 13, lines 18-21. Based upon the above statements in the prosecution history, AccuScan explicitly disclaimed coverage of any device performing the mathematical calculation yielding VO by something other than a divide circuit. This disclaimer applies equally to the "divided by" language of claim 1 and the "quotient" language of claim 17. A[*11] quotient is a number resulting from the division of one number by another, and the clause of claim 17 which contains the "quotient" language clearly refers to the mathematical function resulting in the "third output signal" corresponding to VO.

It is uncontested that the accused DocuTech publishing system performs the mathematical calculation yielding VO by multiplying by a reciprocal instead of using a divide circuit. Furthermore, it is uncontested that the 5775 copier performs this calculation by subtracting logarithmic values. AccuScan argues that a signal representative of a division or a signal representative of a quotient may be obtained by multiplication of a reciprocal--as is done in Xerox's DocuTech system--or by subtracting logarithmic values--as is done in Xerox's 5775 copier. Certainly, this is mathematically correct. Under different circumstances, it would be entirely possible to determine that a divide function could encompass multiplication by a reciprocal or logarithmic subtraction, either literally or under the doctrine of equivalents. In the present case, however, AccuScan explicitly disclaimed such an interpretation during prosecution. Therefore, there can be no[*12] infringement of either claim 1 or claim 17 with respect to either the DocuTech publishing system or the 5775 copier.

However, the record with regard to the SA-4 scanner and the 7117/20/21 facsimile machines is not as clear. Both of these machines utilize digital circuits, as opposed to the analog ABC circuit of the '144 patent. The evidence and testimony presented regarding these two products is simply not sufficient for this court to determine whether or not the SA-4 scanner and the 7117/20/21 facsimile machines "divide" to obtain VO or perform some other mathematical function. Thus, we consider a second aspect of the claim construction.

Xerox also argues that its four products cannot infringe under a correct claim construction because AccuScan specifically argued during prosecution that the claims did not cover circuits that do not store and hold a white sample during the entire scan of the document, and do not continually combine the input signal with the black and white samples during the entire scan of the document. The prosecuting attorney characterized the invention of the '144 patent as performing the following:

In response to the second sampling signal, the ABC unit[*13] stores in the input capacitor of a second operational amplifier a second sample of the video input signal corresponding to the white shade or value of the calibration strip being scanned. Thus, at the completion of the calibration scan separate black and white representing samples of the input video signal are held stored in the input capacitors of their respective operational amplifiers, which produce corresponding output voltage signals Vh and Vw representative of the voltage magnitudes of the black and white samples.

The prosecuting attorney distinguished the Krallinger reference from the invention of the '144 patent by describing Krallinger in the following manner:

The immediately following white signal is not sampled or stored but instead, because of its appearance immediately following the black signal, is used in a servo operation to vary the gain of the controllable amplifier so that the amplified white signal is equal to a preset reference voltage Vr. This amplification or gain level once obtained, is held throughout the complete line by the cumulative charge stored in an error capacitor 52 which represents the cumulative level of the error signals produced in[*14] the slewing operations of the gain control servo of the amplifier. Capacitor 52 is a storage element but it does not store a sample of the white signal, and, moreover, a sample of the white signal is not stored at any place or position in the Krallinger, et al. circuit.

Thus, during prosecution of the '144 patent, AccuScan repeatedly emphasized the importance of storing a sample of the white signal. Furthermore, AccuScan distinguished the '144 patent over other devices which did not store a sample of the white signal. Although Krallinger does use the white sample signal to create a related value which is then stored, the prosecution history makes it clear that such a mathematically related value is not equivalent to the '144 patent's storage of a separate white sample signal.

The prosecution history of the '144 patent also makes it clear that a distinguishing feature of the '144 patent is the continual storage and continuous use of the separately stored black and white samples throughout the scanning of an entire document. Such continuous storage and usage statements were made repeatedly by the prosecuting attorney, including:

It is clear that the ABC unit of the present[*15] invention is characterized by fully automatic acquisition of separate black and white samples of the video signal by the

continual storage of the separate black and white samples throughout the subsequent scanning and transmission of a document, and by the continuous use during such period of the separately stored black and white samples to continuously correct the video signal received during the scanning of the document. (emphasis added).

When interpreted in light of these statements, both claim 1 and claim 17 require continuous "storing" of the Vw value in its pure form, and continuous "combining" of this value throughout the scanning of the document.

The diagrams of the operation of the Xerox devices created by AccuScan make it clear that the four different Xerox product lines at issue only temporarily store the white sample Vw in its pure form. These four illustrative diagrams all show that Vw is stored only temporarily before being converted to the difference value (Vw-Vb). There is no dispute that this is a correct characterization of the accused Xerox products. Because Vw in its pure form is stored only temporarily, it cannot be used continuously[*16] as required by the '144 patent claims as interpreted in light of the prosecution history.

For purposes of infringement under the doctrine of equivalents, the patentee is also bound by the clear and unmistakable surrender of the structure employed by Xerox. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co. Ltd.*, 234 F.3d 558, 564, 56 USPQ2d 1865, 1869 (Fed. Cir. 2000); *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 988 F.2d 1165, 1173, 26 USPQ2d 1018, 1024-25 (Fed. Cir. 1993). Thus, none of the products in the four accused Xerox product lines may be held to infringe either of the asserted claims of the '144 patent either literally or under the doctrine of equivalents.

III

Xerox counterclaimed that the '144 patent was invalid pursuant to 35 U.S.C. § 102(b) under two different theories: anticipation and the on-sale bar. We address each of these theories in turn.

A

Xerox alleges that the '144 patent is anticipated by an IBM Technical Disclosure Bulletin by D.P. Swart entitled "Contrast Amplifier," Vol. 14, No. 3 (August 1971) 883-84 ("the IBM reference"). In order to anticipate a claim, a prior art reference[*17] must disclose every element of the claimed invention. *Atlas Powder Co. v. IRECO Inc.*, 190 F.3d 1342, 1346, 51 USPQ2d 1943, 1945 (Fed. Cir. 1999). Anticipation is a factual

question, and a jury verdict regarding anticipation is reviewed after trial for substantial evidence. *ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 544, 48 USPQ2d 1321, 1328 (Fed. Cir. 1998). At trial, the jury in this case ruled that the '144 patent was not anticipated by the IBM reference, and the district court held that substantial evidence supported this jury verdict. We agree.

The IBM reference discloses a contrast amplifier circuit, which operates using the principle:

$$(Vw - Vs) / (Vw - Vb)$$

This equation differs from the "Kolker equation" as used in the '144 patent in that the black sample Vb is not used as the first sample. In order to show that the IBM reference is anticipatory, Xerox must show that the district court's claim construction for the '144 patent requiring the first sample stored to be the black sample is erroneous. The relevant portion of claim 1 states:

A. means for storing a first sample of said input signal when said input parameter is at its first[*18] magnitude;

B. means for storing a second sample of said input signal when said input parameter is at its second magnitude;

'144 patent, col. 18, lines 62-66.

Xerox concedes that the preferred embodiment disclosed in the '144 patent specification stores black as the first sample Vb and white as the second sample Vw, but relies upon the rule that the claims are not limited to the disclosed embodiments. See *Tate Access Floors, Inc. v. Maxcess Techs., Inc.*, 222 F.3d 958, 966, 55 USPQ2d 1513, 1518 (Fed. Cir. 2000). However, this analysis ignores the means-plus-function aspect of these two phrases. Claims that invoke a means-plus-function analysis under 35 U.S.C. § 112, P 6 are held to only encompass "all structure in the specification corresponding to that element and equivalent structures." *Micro Chem., Inc. v. Great Plains Chem. Co. Inc.*, 194 F.3d 1250, 1258, 52 USPQ2d 1258, 1263 (Fed. Cir. 1999).

Claim 1 recites "means for storing a first sample" (clause A) and "means for storing a second sample" (clause B). This language clearly invokes a means-plus-function analysis. Xerox argues that the means-plus-function[*19] analysis applies only to the "means for storing" language and does not relate to the "first sample" and "second sample" language of claim 1. It is true that "section 112, P 6 does not limit all terms in a

means-plus-function. . . clause to what is disclosed in the written description. . . .” *IMS Tech., Inc. v. Haas Automation, Inc.*, 206 F.3d 1422, 1432, 54 USPQ2d 1129, 1135 (Fed. Cir. 2000). However, in the present case, it is not possible to distinguish between the “means for storing” embodiments in the written description of the ‘144 patent without considering either the first or second sample language as an integral part of these phrases.

The prosecution history also limits the ‘144 patent to storing a black sample first and a white sample second. The prosecuting attorney described the invention of the ‘144 patent as operating to:

produce a first sampling signal when the ramp voltage reaches a predetermined magnitude corresponding to the scanning of the black area of the calibration strip and produces a second sampling signal when the ramp voltage reaches a second predetermined magnitude corresponding to the scanning of the white area of the calibration[*20] strip.

The prosecution history also explicitly describes the invention of the ‘144 patent as operating using the Kolker equation. Thus, during prosecution AccuScan surrendered coverage of a circuit operating in a manner different from the Kolker equation. For this reason, claim 17 is also limited to the Kolker equation and is not anticipated by the IBM reference.

Every embodiment and example disclosed in the patent, as well as the prosecution history, involves storing a black sample first and a white sample second, and the district court correctly construed the claims to cover only this scenario. Thus, the ‘144 claims cover only the Kolker equation disclosed in the ‘144 patent, which clearly differs from the equation disclosed in the IBM reference. Xerox advances no other argument (including any argument based upon equivalency of structure) aside from claim construction to refute the jury verdict. Substantial evidence supports the jury’s verdict that the IBM reference does not anticipate the ‘144 patent.

B

Xerox also argues that the ‘144 patent is invalid because the invention was allegedly offered for sale by AccuScan more than one year prior to the date of application[*21] for the ‘144 patent. 35 U.S.C. § 102(b) (1994). Under *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 66-68, 142 L. Ed. 2d 261, 119 S. Ct. 304 (1998), the old “substantially complete” standard for determining whether the on-sale bar has been triggered has been streamlined and modernized to a two-prong test: 1)

whether the patented invention was the subject of a commercial offer for sale, and 2) whether the patented invention was “ready for patenting” prior to the critical date. Although the ultimate determination of invalidity due to application of the on-sale bar is a question of law, the facts underlying satisfaction of both of these conditions are issues of fact. *Monon Corp. v. Sloughon Trailers, Inc.*, 239 F.3d 1253, 1257, 57 USPQ2d 1699, 1702-03 (Fed. Cir. 2001).

Due to the intervening change in the law under *Pfaff* regarding the on-sale bar, the issue of whether the invention of the ‘144 patent was on sale prior to the critical date was tried to the jury on two separate occasions, and in both trials the jury ruled that the ‘144 patent was not invalidated by the on-sale bar. The district court twice upheld the jury verdict[*22] as supported by substantial evidence. However, the district court’s first opinion upheld the jury verdict under the rationale that because the sale at issue was entitled a “Research and Development Contract,” it did not qualify as a real sale. *AccuScan, Inc. v. Xerox Corp.*, 96 Civ. 2579 at 6-7 (S.D.N.Y. Sept. 11, 1998). *Zacharin v. United States*, 213 F.3d 1366, 1370, 55 USPQ2d 1047, 1050 (Fed. Cir. 2000), states: “the fact that the sale in question was made in the context of a research and development contract and that there was no fixed price set for the [products] does not suffice to avoid the on-sale bar.” Therefore, the district court’s ruling on this point was legally incorrect. The district court’s second ruling on the on-sale bar issue again affirmed the jury verdict as supported by ample evidence, but did not explain this ruling by pointing out the evidence which was relied upon. *AccuScan, Inc., v. Xerox Corp.*, 96 Civ. 2579 at 3 (S.D.N.Y. Mar. 15, 2000). Thus, for clarity we will briefly outline the points of evidentiary contention.

The application which matured into the ‘144 patent was filed on October 2, 1974, with Ray Kolker being the sole named[*23] inventor. Testimony from Mr. Kolker validated a detailed schematic of the ABC circuit dated February 28, 1972, as “the electrical schematic of my invention.” Thus, the evidence supports a finding that the invention of the ‘144 patent was “ready for patenting” prior to the critical date.

The second part of the on-sale test is the occurrence of a commercial offer for sale, which is the critical prong of the test in the present case. AccuScan submitted a proposal to the California Crime Technological Research Foundation (“CCTRF”) in January 1973, which appears to qualify as an offer for sale. However, at trial, AccuScan presented evidence suggesting that the sub-

ject matter contained in the CCTRF proposal was not the Kolker ABC circuit invention of the '144 patent, but rather was an alternative design developed by Xerox witness Robert LaFond. The subject matter of the commercial offer for sale must "be something within the scope of the claims," and therefore the use of this alternative design would indicate that the invention of the '144 patent was not part of the CCTRF offer for sale. *Scaltech Inc. v. Retec*, 178 F.3d 1378, 1383, 51 USPQ2d 1055, 1058 (Fed. Cir. 1999).[*24]

Xerox disputes that any alternative design from Mr. LaFond ever existed, and presented testimony to that effect. Overall, the testimony presented at trial is conflicting. The CCTRF proposal lists Mr. LaFond and Mr. Dobrin (VP of Phonapix, the predecessor to AccuScan) as responsible for the program, but makes no mention of Mr. Kolker. Mr. LaFond testified that the CCTRF proposal did contain the Kolker ABC circuit of the '144 patent. However, Mr. LaFond also admitted that the CCTRF proposal schematic attachment did not contain a block diagram labeled "ABC circuit." Mr. Dobrin said that Mr. LaFond did have an alternative circuit, but Mr. Dobrin did not know many details about what went into the Phonapix Fax machines that were the subject of the CCTRF proposal. Mr. Kolker testified that the CCTRF

proposal "absolutely does not" describe his invention of the '144 patent.

Credibility determinations and the weighing of evidence are jury functions. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986). Although there was some conflicting evidence presented, the jury twice found that the weight of the evidence favored AccuScan. On[*25] appeal, we find that substantial evidence exists to support the jury's verdict. Therefore, the '144 patent has not been shown to be invalid pursuant to the on-sale bar.

V

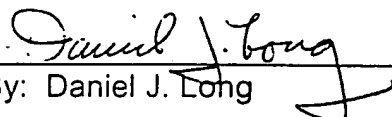
The district court's denial of Xerox's motion for JMOL of noninfringement is reversed. The district court's denial of Xerox's motion for JMOL of invalidity pursuant to 35 U.S.C. § 102(h) is affirmed. Our ruling regarding noninfringement renders the additional issues in the case moot.

COSTS

No costs.

CERTIFICATE OF SERVICE

In accordance with 37 CFR § 1.292 (a)(4) this response is being served by first class mail on Susan L. Christenberry, Esq. and Louis A. Tarasi, Jr., Esq. on November 9, 2001.


By: Daniel J. Long



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: S. Stevenson

Serial No: 09/652,272

Examiner: Hruskoci, P.

Filed: August 30, 2000

Art Unit: 1724

For: METHOD AND APPARATUS FOR REMOVING METAL COMPOUNDS FROM
WASTE WATER

Assistant Commissioner for Patents
Washington, D.C. 20231

REQUEST FOR EXTENSION OF TIME

Dear sir:

Further to applicant's request of October 26, 2001, applicant requests an additional seven day extension of time until November 9, 2001 to file this response since applicant had recently been traveling and needed additional time to review and sign a declaration which was part of his response.

NO. 058 ✓

Inventor/Applicant: S.M. STEVENSON
Title: INTERNAL INFORMATION FOR KIDNAPING
Attorney Docket No. 813-A-00-00-00-00 Initials SM Date 11-9-01

Pat. No.: 06 467 856 467
Ser. No.: 001 652 272
Filed: 8-31-00
Date: 11-9-01

☐ **PATENT/DESIGN APPLICATION**

- ☐ UTIL ☐ PRO ☐ CONT. ☐ CIP
☐ DIV ☐ PCT ☐ RCE
☐ Declaration/Power of Att.
☐ Pages Specification
☐ Pages Claims
☐ total ☐ independent
☐ Pages Abstract
☐ Sheet(s) of drawing(s)
☐ formal ☐ informal
☐ Preliminary Amendment

☐ **APPLICATION DATA SHEET**

☐ **PCT REQUEST**

☐ **CHECK(S)** in Amount \$ 130.00

☐ **AMENDMENT (Due _____)**

____ Ext. of Time for _____ Month(s)

☐ **ISSUE FEE**

☐ **TRANSMITTAL**

- ☐ New Application ☐ Amendment
☐ Assignment ☐ Issue Fee
☐ Fees ☐ General

☐ **CERTIFICATE OF MAILING**

☐ **EXPRESS MAIL NO.**

☒ **OTHER**

REQUEST FOR EXT.
REPLY TO 001 652 272
DEPT. OF JUSTICE

RECEIPT IS HEREBY ACKNOWLEDGED

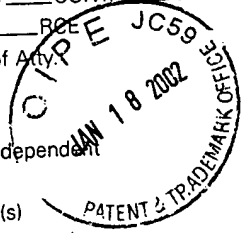


EXHIBIT 1



[54] METHOD FOR REMOVING METAL COMPOUNDS FROM WASTE WATER

[76] Inventor: Sanford M. Stevenson, 124 Braun Dr., McMurray, Pa. 15317

[21] Appl. No.: 72,418

[22] Filed: May 25, 1993

[51] Int. Cl. C02F 1/36

[52] U.S. CL. 210/710; 210/721;
210/722; 210/725; 210/727; 210/738; 210/747;
210/911; 210/912; 210/913

[58] Field of Search 210/710, 721, 722, 724,
210/725, 727, 728, 738, 768, 770, 912, 913, 747,
911

[56] References Cited

U.S. PATENT DOCUMENTS

3,931,007 1/1976 Sugano et al. 210/721
4,159,248 6/1979 Taylor et al. 210/96.1
4,192,743 3/1980 Bastgen et al. 210/770

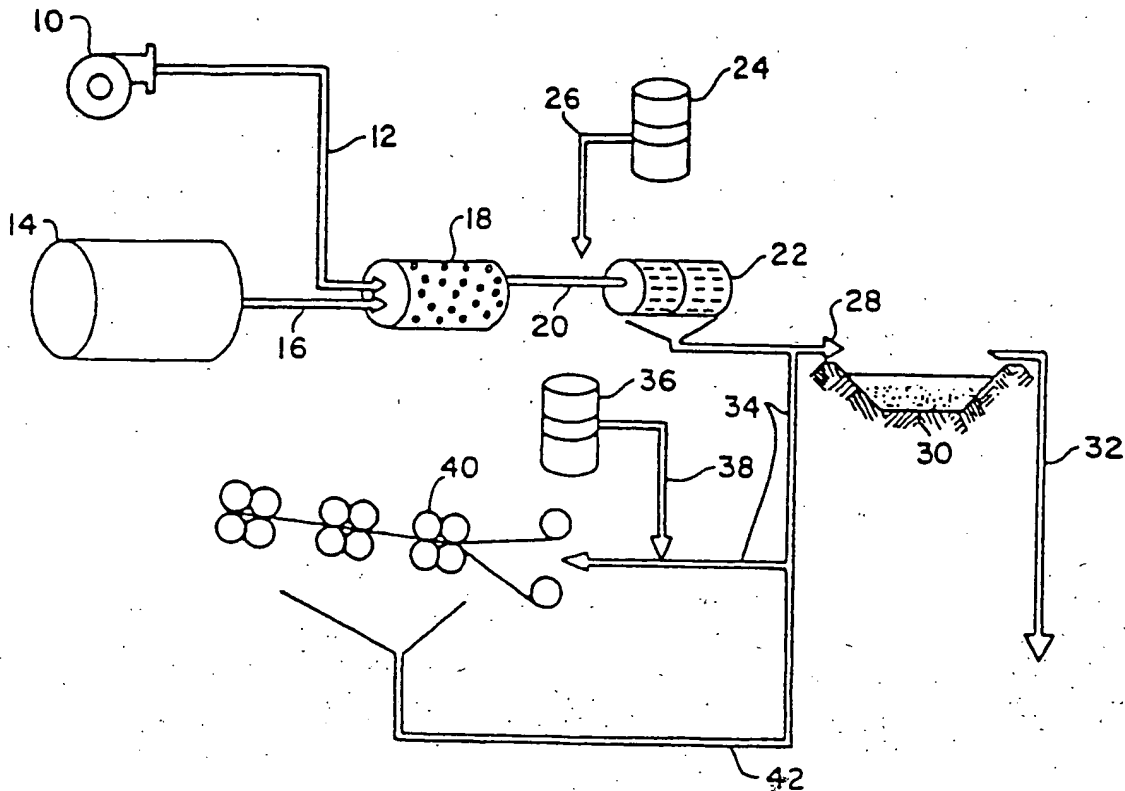
4,632,758 12/1986 Whittle 210/603
4,724,084 2/1988 Pahnseier et al. 210/725
4,749,497 6/1988 Kamleiter et al. 210/721
4,758,353 7/1988 Spence et al. 210/725
4,814,091 3/1989 Napier et al. 210/665
5,013,453 5/1991 Walker 210/721

Primary Examiner—Peter A. Hruskoci
Attorney, Agent, or Firm—Daniel J. Long

[57] ABSTRACT

A method for removing metal compounds from waste water comprising the steps of adjusting the pH of the water to from 5 to 12 and preferably 6 to 9; aerating the waste water; adding a flocculating agent to the water and allowing floccules including metal compounds to form; and separating said floccules including metal compounds from the water. An apparatus for carrying out this method is also disclosed.

25 Claims, 2 Drawing Sheets



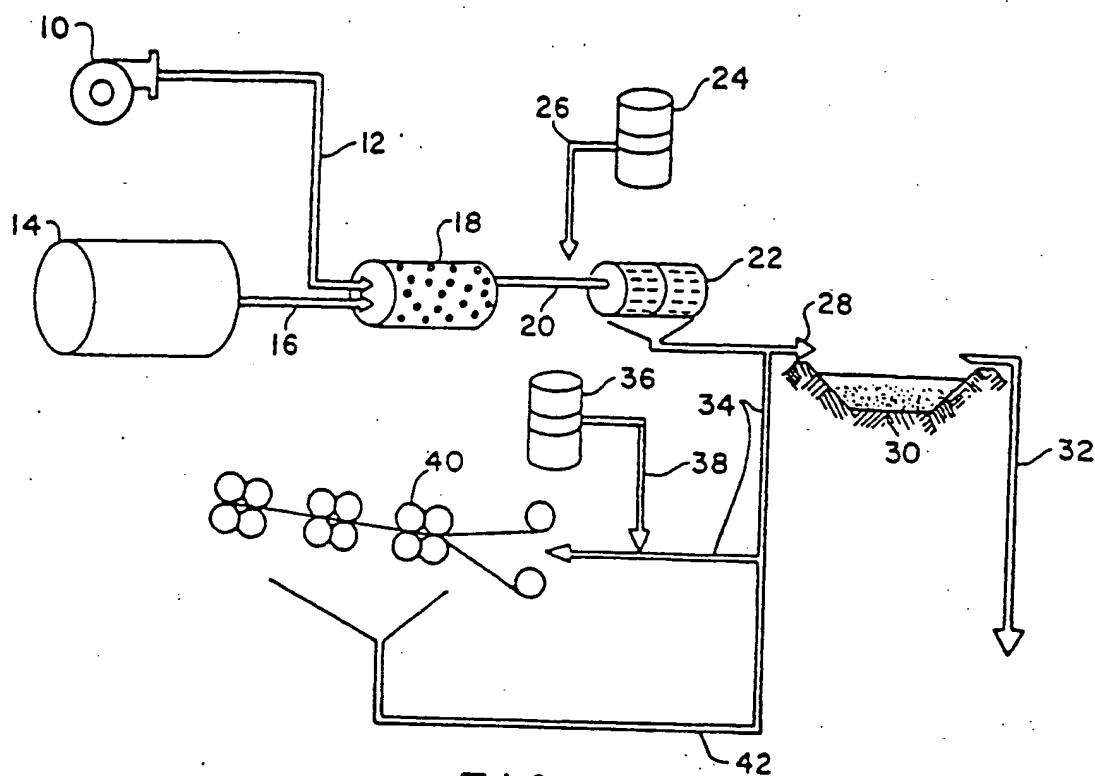


FIG. 1

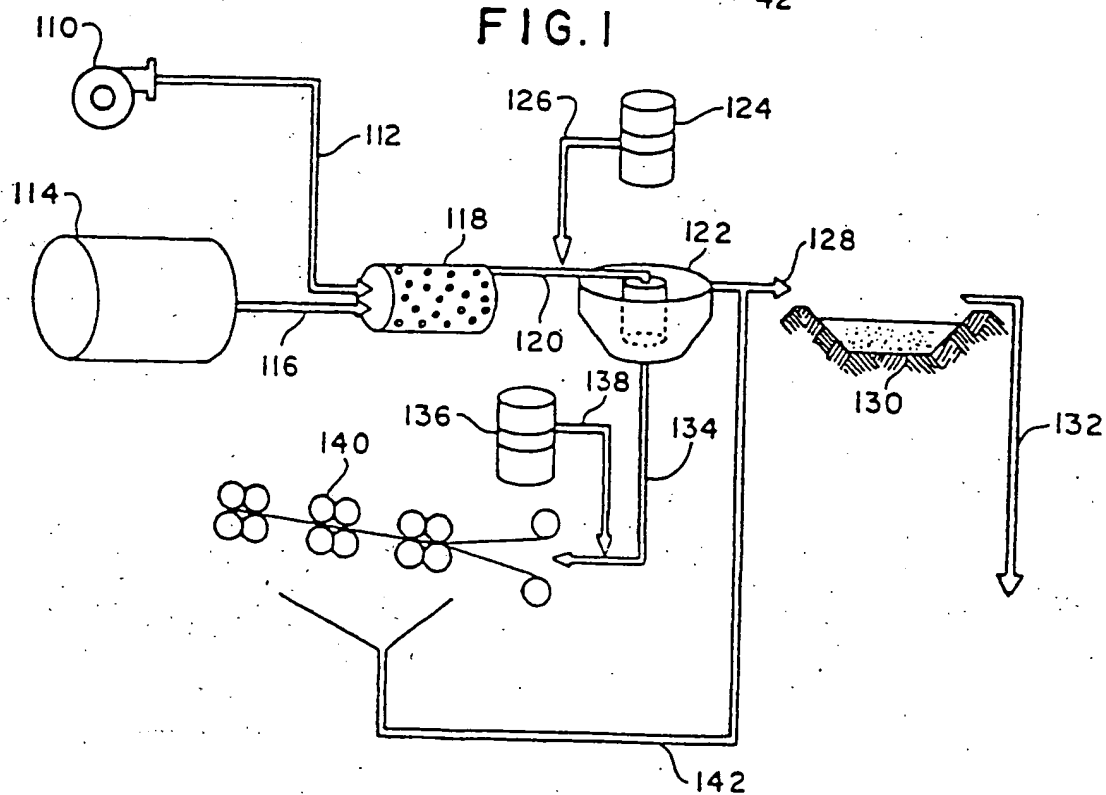


FIG. 2

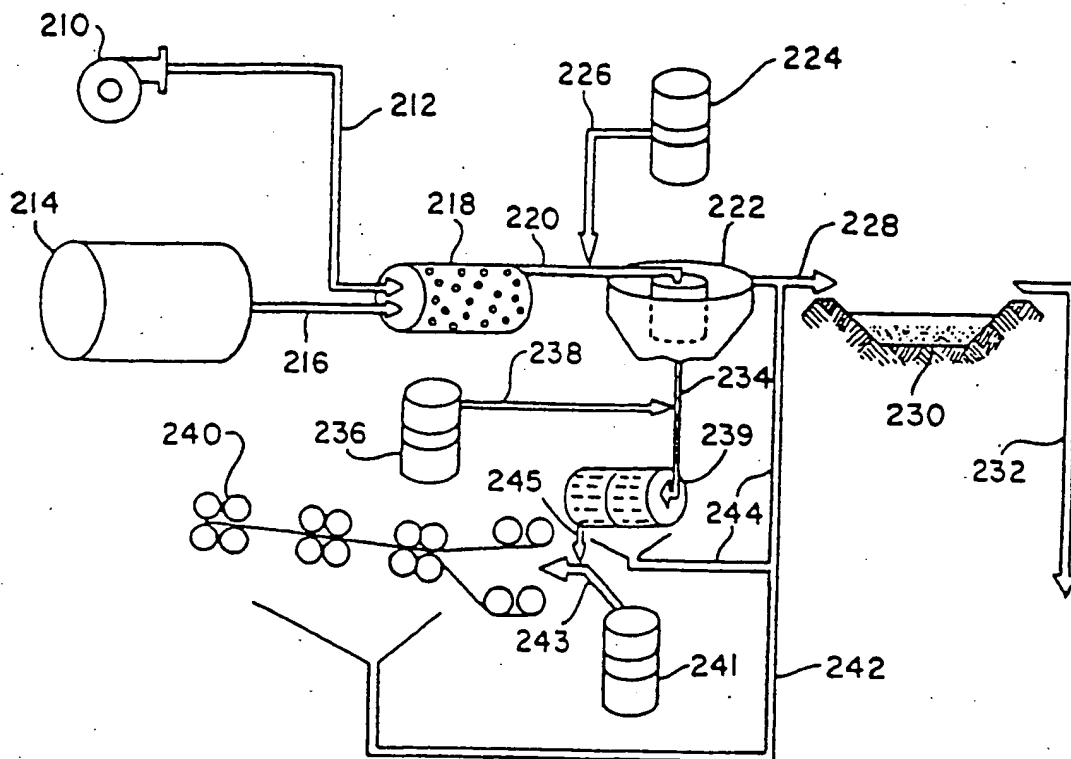


FIG. 3

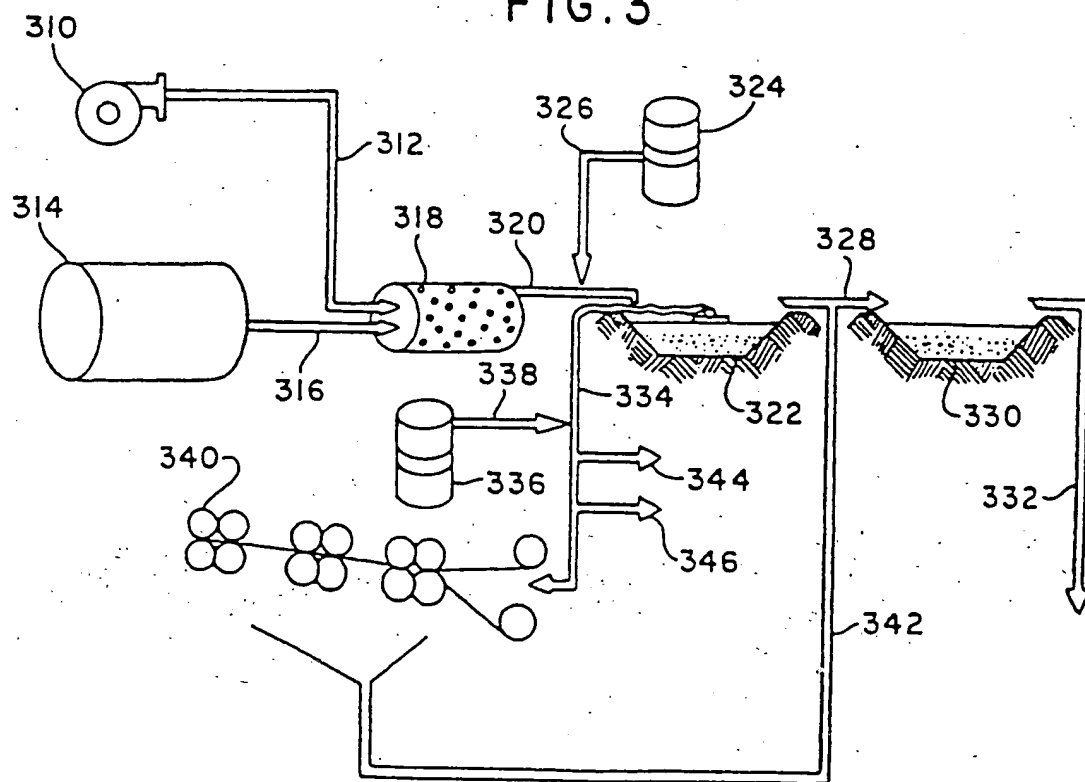


FIG. 4

METHOD FOR REMOVING METAL COMPOUNDS FROM WASTE WATER

BACKGROUND OF THE INVENTION

The present invention relates to the treatment of waste water, and, in particular, to the treatment of water to remove various precipitated or suspended metal compounds therefrom.

Runoffs from a number of industrial operations such as electrical power plants, steel plants and mines are known to be contaminated with various metal compounds including iron, manganese, aluminum, zinc, copper, lead, arsenic and chromium. Such contaminants may pose a serious environmental problem. Methods heretofore used to remove such contaminants have included the use of additional lime, soda ash or other neutralizing agents and the use of holding ponds or clarifying tanks. Such methods have not, however, been entirely satisfactory because of the lengthy periods of time which they would generally be required to effect treatment.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved method and apparatus for removing precipitate or suspended metal compounds from waste water.

In this method the pH of the water is first adjusted from 6 to 10. Preferred neutralizing agents are sodium hydroxide, and anhydrous ammonia when the waste water is overly acidic or sulfuric acid or hydrochloride acid when it is overly basic. The water is also aerated to a dissolved oxygen concentration of from 0.01 lb./hr. to 70 lb./hr. at a raw water input flow rate of 50 gal./min. to 500 gal./min. Neutralization and aeration may preferably be done simultaneously. A polymeric flocculating agent is then added to the water. The metal compounds are then flocculated, and the flocculated metal compounds are separated from the water by means of a rotary drum thickener, clarifier or other suitable means. A preferred flocculating agent is an anionic or cationic polymer wherein the use of an anionic polymer would be preferred for primary clarification or settling purposes while the cationic polymer would be preferred for dewatering purposes. The flocculated metal compounds are then further dewatered in a belt filter press or other suitable apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is further described with reference to the accompanying drawing in which:

FIG. 1 is a schematic drawing of apparatus used to carry out one preferred embodiment of the method of the present invention;

FIG. 2 is a schematic drawing of apparatus used to carry out another preferred embodiment of the method of the present invention;

FIG. 3 is a schematic drawing of apparatus used to carry out a third preferred embodiment of the method of the present invention; and

FIG. 4 is a schematic drawing of apparatus used to carry out a fourth preferred embodiment of the method of the present invention.

DETAILED DESCRIPTION

Referring to FIG. 1, the raw water source is shown at numeral 10. Waste water is removed from this source in

line 12. Neutralizing agent tank 14 is connected by line 16 to reaction tank 18 where water from line 12 is simultaneously mixed with neutralizing agent, aerated and agitated. A preferred embodiment of the reaction tank 18 is described in U.S. Pat. No. 4,749,497 although it has now been found that in some cases the apparatus disclosed in that patent may be advantageously modified by the removal of its baffles and the relocation of the aeration mixing unit to a 45° angle to the vertical plane of the reaction tank. The rate of aeration would normally be from about 0.01 lbs./hr. to about 70 lbs./hr. for a metals concentration of 50 mg./l. to 1,000 mg./l. at a raw water input flow rate of 50 gal./min. to 500 gal./min. The pH of the water is adjusted to between 5 and 12 and preferably to between 6 and 9. It will be understood that for regulatory reasons if the pH is adjusted to above 9, it will ordinarily be necessary to reduce the pH to below that level on completion of the process described herein. The water is then removed in line 20 to rotary drum thickener 22. A flocculating agent from polymer tank 24 is also moved in line 26 to line 20 to be mixed with the water in rotary drum thickener 22 where the metal compounds are flocculated and separated. Such polymers which are used for primary clarification purposes are anionic polymers. NALCO 7767 is a suitable commercially available anionic polymer. Cationic polymers may be used for dewatering purposes and may be selected from the following commercially available polymers: PERCOL AC 737 and UNIFLOC 630. Water from the rotary drum thickener is removed in line 28 to polishing pond 30 from where outfall is removed in line 32. Water and flocculated metal compounds are removed from the rotary drum thickener in line 34. Additional polymer from polymer tank 36 is moved in line 38 to be mixed with water and flocculated metal compound in line 38 which are then moved to belt filter press 40 where the flocules are dewatered and from which water is removed to the polishing pond in line 42.

Referring to FIG. 2, waste water from a raw water source 110 is removed in line 112 to be mixed with neutralizing agent from tank 114 moved in line 116 to reaction tank 118. The neutralized, aerated and agitated water is then removed in line 120 to clarifier 122 to which flocculating agent from polymer tank 124 through line 126 is mixed. Water is removed from the clarifier in line 128 to polishing pond 130 from where outfall is released from line 132. Flocculated metal compound along with water is removed from the clarifier in line 134 from where is mixed with additional polymer from polymer tank 136 and line 138 and then dewatered in belt filter press 140 where additional water is removed and transported to the polishing pond in line 142.

Referring to FIG. 3, waste water from raw water source 210 is removed in line 212 and neutralizing agent from tank 214 is removed in line 216 to reaction tank 218 from where it is removed in line 220 to clarifier 222 after being mixed with flocculating agent from polymer tank 224 moved through line 226. Water from the clarifier is removed in line 228 to polishing pond 230 from where outfall is removed in line 232. Flocules containing metal compounds are removed with water from the clarifier in line 234. Additional polymer from polymer tank 236 removed in line 238 to be mixed with the flocules which are then introduced to rotary drum thickener 239 and are then introduced to belt filter press 240

after mixed with additional polymer from tank 241 which is removed in line 243 and mixed with water from the rotary drum thickener removed through line 245. Water from the belt filter press is removed in line 242 and transformed with water from line 244 from rotary drum thickener 239 to the polishing pond.

Referring to FIG. 4, waste water from raw water source 310 is removed in line 312 and mixed with neutralizing agent from tank 314 and line 316 in reaction tank 318 from where water is removed in line 320 to settling pond 322. Flocculating agent is introduced from polymer tank 324 through line 326. Water is removed from the settling pond in line 328 to polishing pond 330 from where outfall is removed in line 332. Floccules containing metal compound along with water are removed in line 334 and are mixed with additional polymer from tank 336 introduced through line 338 and then dewatered in belt filter press 340 from which water is removed to the polishing tank in line 342. Alternatively, portions of the floccules, water and polymer mixture in line 334 are also diverted to borehole 344 and drying bed 346.

The method and apparatus of the present invention is further described with reference to the following example.

EXAMPLE

350 GPM of waste water having a pH of 2, having dissolved metal concentrations of 10,000 ppm was first pumped from a collection area to a reaction vessel where it was aerated and agitated at a dissolved oxygen concentration of 3 lb./HP hour. Sodium hydroxide was added automatically as the neutralizing agent, at juxtaposition to the waste water, aeration and agitation point, to an adjusted pH of 8.5. The neutralized waste water is transferred to a flocculator reactor where a UNIFLOC 630 cationic polymer is added at a rate of 2 GPM. The instantaneous agglomeration of the neutralized waste water was transferred to a rotary drum thickener where water was filtered from the metal hydroxide sludge, where supernate water was removed to a polishing pond at a rate of approximately 300 GPM. Metal hydroxide sludge was removed from the rotary drum thickener at a rate of approximately 50 GPM to a belt filter press where a cationic polymer was added at a rate of 1 GPM. After processing through the belt filter press cake solids were recovered at a 15% to 40% dry solids. Water leaving the polishing pond consistently had a metal ion concentration below EPA permitted limits.

Although the invention has been described with a certain degree of particularity, it is to be understood that the present disclosure has been made only as an example and that the scope of the invention is defined by what is claimed hereafter.

What is claimed is:

1. A method for removing metal compounds selected from iron, manganese, aluminum, zinc, copper, lead, arsenic and chromium from waste water comprising the steps of:

(a) adjusting the pH of the waste water to from about 5 to about 12;

(b) aerating the waste water;

(c) agitating the waste water, where steps (a), (b) and (c) are carried out simultaneously in a reaction tank and waste water is aerated in said reaction tank to provide a dissolved oxygen concentration at from about 0.01 lb./hr. to about 70 lbs./hr. at a waste

water input flow rate of from about 50 gal./min. to about 500 gal./min. for a metals concentration of from about 50 mg./l. to about 1,000 mg./l.

(d) then adding a flocculating agent polymer selected from a group consisting of cationic and anionic polymers to the water and allowing floccules including said metal compounds to form; and

(e) then separating said floccules including said metal compounds from the water.

2. The method of claim 1 wherein there is added the further step (f) of further dewatering the floccules separated in step (e).

3. The method of claim 2 wherein additional flocculating agent polymer is added to at least a portion of the waste water containing the flocculated metal compound separated in step e.

4. The method of claim 3 wherein after the addition of the additional flocculating agent polymer, the flocculated metal compound is dewatered in step (f) in a belt filter press.

5. The method of claim 4 wherein there is water which is removed in step (f) and said water removed in step (f) is removed to a polishing pond.

6. The method of claim 2 wherein in step (e) separation is conducted by means of a clarifier.

7. The method of claim 6 wherein additional flocculating agent is added to at least a portion of the flocculated metal compound separated in step (e).

8. The method of claim 7 wherein after the addition of the additional flocculating agent polymer, the flocculated metal compound is dewatered in step (f) in a belt filter press.

9. The method of claim 8 wherein there is water removed in step (f) and said water removed in step (f) is removed to a polishing means.

10. The method of claim 2 wherein in step (e) separation is conducted by means of sequential treatment in a clarifier and a rotary drum thickener.

11. The method of claim 10 wherein additional flocculating agent polymer is added after the clarifier and then again after the rotary drum thickener.

12. The method of claim 11 wherein after the additional flocculating agent polymer, the flocculated metal compound is dewatered in step (f) in a belt filter press.

13. The method of claim 12 wherein there is water removed in step (f) and said water removed in step (f) is removed to a polishing pond.

14. The method of claim 11 wherein water removed in step (f) is removed to a settling pond.

15. The method of claim 2 wherein in step (e) separation is conducted by means of a settling pond.

16. The method of claim 15 wherein additional flocculating agent is added after the settling pond.

17. The method of claim 16 wherein after the additional polymer is added the flocculated metal compound is dewatered in step (f) in a belt filter press.

18. The method of claim 1 wherein in step (a) the pH is adjusted to from about 6 to about 9.

19. The method of claim 1 wherein in step (a) the pH is adjusted by adding a neutralizing agent selected from sodium hydroxide, anhydrous ammonia, sulfuric acid and hydrochloric acid.

20. The method of claim 1 wherein the polymer is a cationic polymer which is used for dewatering purposes.

21. The method of claim 1 wherein the polymer is an anionic polymer which is used for primary clarification purposes.

22. The method of claim 1 wherein the polymer is an anionic polymer which is used for settling purposes.

23. The method of claim 1 wherein the polymer is added in a dilute concentration of from about 0.5% to about 1.5% by weight.

24. The method of claim 1 wherein after step (c) a

portion of the separated water is removed to a polishing pond.

25. The method of claim 1 wherein in step (e) separation is conducted by means of a rotary drum thickener.
* * * * *

10

15

20

25

30

35

40

45

50

55

60

65

EXHIBIT 2

1 THE COURT: Was that due to the low pH of the
2 effluent?

3 THE WITNESS: Partly from the low pH and there may
4 have been some other -- there may have been some carbonates
5 in the water. We -- to this day, I don't know the reason
6 why.

7 THE COURT: So just to summarize them, you
8 experimented with the polymers --

9 THE WITNESS: Yes, sir.

10 THE COURT: -- you experimented with their
11 dilution.

12 THE WITNESS: That is correct.

13 THE COURT: You experimented with the dosage.

14 THE WITNESS: That's correct.

15 THE COURT: You experimented with the pH in the
16 reactor vessel.

17 THE WITNESS: That's correct.

18 THE COURT: Did you experiment with the injection
19 points at all of the polymer?

20 THE WITNESS: Yes, we did.

21 THE COURT: Okay. What did you do with that?

22 THE WITNESS: Moved them. And sometimes just
23 moving them a foot or moving them two feet for resonance
24 time was enough. There are two steps there. One step is
25 for the initial settlement of the sludges. The second one

EXHIBIT 3

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

No. : 97-21C

Volume II

Pages: 264 through 492

Place: Pittsburgh, Pennsylvania

Date: November 16, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20005-4018

(202) 628-4888

hrc@concentric.net

1 THE COURT: Okay. How about determining the
2 injection point of the polymers in terms of treating that
3 waste water stream?

4 THE WITNESS: There is also some experimentation
5 that goes along with that. But historical --

6 THE COURT: Experimentation in the laboratory
7 first or experimentation -- or are we talking about field
8 testing?

9 THE WITNESS: If you have a field testing and have
10 the time to do it in the field.

11 THE COURT: All right. That is all I have.

12 THE WITNESS: Thank you, Your Honor.

13 THE COURT: Let me start with you, Mr. Elliot.

14 MR. ELLIOT: Yes, Your Honor. If you would give
15 me just a moment.

16 THE COURT: Sure. I appreciate both of you not
17 objecting to one of my questions.

18 MR. TARASI: Your Honor, I had one look at me one
19 time and the Judge says, "What?"

20 THE WITNESS: I would like to know if I got the A.

21 FURTHER REDIRECT EXAMINATION

22 BY MR. ELLIOT:

23 Q Mr. Stevenson, the pH range of 8.4 to 8.5, in
24 fact, was designed to optimize removal of copper rather than
25 of the 20 California-listed metals, right?

EXHIBIT 4

No. : 97-21C

Official Reporters
1220 L Street, N.W., Suite 600
Washington, D.C. 20005-4018
(202) 628-4888
hrc@concentric.net

1 Q Do you say anywhere in your -- you don't say
2 anywhere in your report that a metal-metal compound such as
3 barium chromate is a metal compound as one skilled in the
4 art would understand Claim 1 of the 800 patent, isn't that
5 right?

6 A No, sir. That one skilled in the art would
7 understand that.

8 Q Well, that is not what it says in your expert
9 report, is it, Dr. Roth?

10 A No, sir. It is not.

11 Q Dr. Roth, in your opinion, prior to actually
12 removing copper from a waste stream with the method and
13 apparatus of the 800 patent, one skilled in the art would
14 not have been able to predict with confidence that the
15 invention claimed in -- inventions claimed in the 800 patent
16 would be able to remove copper. Is that right?

17 A That is correct. There was no -- I found no
18 evidence in the literature to support that it would.

19 Q The removal of copper from water was a well known
20 art prior to 1993, isn't that right?

21 A That is correct.

22 Q And one can remove copper from a waste stream just
23 by changing the pH. Isn't that right?

24 A That is correct.

25 Q No aeration is required.

EXHIBIT 5



CONFIDENTIAL

1598
COPY NO. 7
ISSUED TO: PEI-87

PG&E OPERATING SERVICES
COMPANY

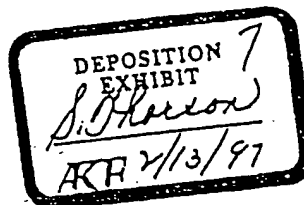
CHEMICAL SEPARATION TECHNOLOGY:

TECHNOLOGY REVIEW,
ASSESSMENT OF MARKET POTENTIAL, AND
RECOMMENDATIONS

MAY 4, 1990

FOR INFORMATION REGARDING
THIS DOCUMENT CONTACT:

- STEVEN L. THORSON
- BILL LEWIS, P.E.
- JEFF LEFEVER



D-93
CHE 00132

3940 GLENBROOK DRIVE
P.O. BOX 1066
HAILEY, IDAHO 83333
(208) 788-3456



CS 10039

CHEMICAL SEPARATION TECHNOLOGY EVALUATION

PART I -- SUMMARY AND RECOMMENDATIONS

SUMMARY

POWER's review of the CST patent and equipment design indicates that the metals removal performance claimed by CST is not unreasonable. However, performance for removal of heavy metals other than iron and manganese remains to be tested, as does the efficiency of a single treatment module in removing metals whose optimum pH for recovery is different. The CST module and sludge removal system, if it operates as claimed and performs similarly on metals other than iron and manganese, would have potential as an alternative to other sludge treatment and removal systems.

POWER's technical review of the CST patent indicates that the patent could be circumvented, though CST's priority in the market -- as well as the potential for legal action -- gives the CST technology some market advantage.

The primary reagent required by the CST system is sodium hydroxide, or caustic. Secure sources of caustic exist, and a number of manufacturers in the Western U.S. are preparing to expand production.

Alternative treatment processes in competition with the CST technology include other systems employing chemical precipitation, including lime precipitation, caustic precipitation, and sulfide precipitation, as well as systems employing other forms of treatment: oxidation, reduction, ion exchange, reverse osmosis, and carbon adsorption.

An interesting potential use for the CST technology is treatment of acid drainage conditions associated with mining operations listed on the Superfund clean-up list.

Another potential application for the CST technology is the treatment of cyanide-bearing waste process waters produced by gold mining operations. Gold mine operators face scrutiny from environmental groups and regulatory agencies, and mining firms are now spending significant amounts of money for treatment and disposal.

There appears to be no reason why the CST system would not work on the oxidation treatment of cyanide. Specific modification recommendations could be made after further evaluation of equipment design. Two specific applications of cyanide treatment within the gold industry should be pursued:

- Tailings cyanide detoxification
- Barren process waters or clarified waste waters from tailings

Marketing the modified CST unit to mine operators is a possibility, though POWER suggests that the CST technology might advantageously be used as a unique proprietary process offered by a clean-up firm specializing in cyanide detoxification.

The use of CST technology for cyanide detoxification should be marketed to large mine operators with significant reserves and low operating costs.

P006435

RECOMMENDATIONS

It is apparent that, while there may be significant long-term mining applications for the CST technology, the short-term prospects are contingent upon future regulatory implementation and enforcement. POWER has identified some near-term prospects for a variation of the process in treatment of cyanide-bearing waste process waters.

While there appears to be considerable potential in this alternative application, we recommend that Operating Services consider implementing the following actions before making any decision on the potential acquisition of CST.

1. An on-site verification of the CST system performance in treatment of heavy metals should be completed. This would involve a site visit, observations and independent sample collection, testing by technical staff, and validation of results.
2. Additional experiments should be conducted to determine if the CST system would be effective in cyanide neutralization, using at least one of the following two alternative approaches:
 - a. Prepare a batch of cyanide-bearing sample material of sufficient volume to permit meaningful testing, and treat the sample at CST's facility. We suggest that the sample volume be no less than 20,000 gallons. This approach would involve considerable attention to proper storage and handling of the sample, as well as disposal of the treated sample, particularly if acid neutralization is not effective.
 - b. Design and build a small-scale pilot treatment unit which duplicates the CST process in miniature. Ideally, this unit would be skid-mounted and portable, using a 3/4-ton truck or flatbed trailer. The pilot plant could be readily transported to one or more sites for testing a sample stream where facilities already exist for containment and disposal of material. The pilot plant could also be used for identification of other applications or for marketing demonstrations if the CST technology proves effective for cyanide neutralization. It may also be possible to obtain funding for initial development of the pilot plant from a regulatory agency such as the EPA, the Bureau of Mines, or a state environmental agency, though POWER notes that pursuing agency funding for a demonstration at a specific site would be easier once the pilot plant is built and in operation.
3. Finally, POWER suggests that the greatest profit potential from use of the CST technology for cyanide neutralization appears to lie in offering treatment services, using the CST system as a proprietary technology, rather than in selling equipment or treatment plants to mine or mill operators. We recommend that Operating Services prepare a business plan and financial forecast to identify and analyze the financial potential for return on investment in establishing such a service entity.

p006436

CHEMICAL SEPARATION TECHNOLOGY EVALUATION

PART II -- REVIEW OF TECHNOLOGY AND MARKET POTENTIAL

TECHNOLOGY REVIEW

Basic Treatment System

POWER has reviewed the CST patent and related equipment design for their heavy metals treatment module. Their treatment module combines caustic (sodium hydroxide) and an oxidizer (oxygen from the air) with acid water bearing a high concentration of heavy metal in a highly agitated reaction zone. This purportedly results in a very rapid neutralization of the acid and precipitation of the heavy metals from the waste stream. Per Sandy Stevenson of CST, the key to their system is the fast reaction rates resulting from the introduction of the reactants and the waste stream simultaneously into the agitated reaction zone. Again per Mr. Stevenson, this, combined with a very accurate pH control system, allows high metals removal efficiency at nearly stoichiometric conditions.

The system chemistry, neutralization and subsequent precipitation of metal hydroxides, oxides, or complexes, is relatively straightforward and is discussed in various reference texts. Although no specific claims for removal rates could be checked, it seems reasonable that the system would work in the manner claimed by CST.

One area of concern is the fact that the existing operating systems have been used to remove only iron and manganese from waste streams. Although it is probable that removal of other heavy metals would occur, to determine actual removal efficiencies would require application of CST systems to waste streams bearing other heavy metal constituents.

A related concern is whether a single treatment module could provide high removal efficiencies of several metals in a given stream, since the optimum pH for removal of each metal will be different. For example, chrome (III) hydroxide has its lowest solubility (and thus highest potential for removal) at approximately pH 8.6. Lead hydroxide has its lowest solubility at approximately pH 9.7. At pH 9.7, however, chrome (III) hydroxide's solubility is an order of magnitude greater than its solubility at pH 8.6.

Although this fact is a negative factor in the context of the unit being used as a general treatment system, it does open up the possibility that it could be used to selectively precipitate and recover individual species.

Sludge Recovery System

Of major concern in any treatment system utilizing precipitation is recovery and subsequent disposal of the solids. Per Sandy Stevenson, CST uses flocculent addition before feeding the solids-treated waste stream to their sludge removal system. This system consists of a rotary drum thickener which concentrates the solids from 1/2% to 5%, followed by a belt press which further concentrates the stream to approximately 20 % solids. This sludge treatment system is physically compact and could be delivered to treatment sites on trucks.

P006437

Per Mr. Stevenson, using the CST unit followed by the sludge removal system, the total iron content of the treated waste stream can be reduced to 0.002 mg/l on the waste streams they are presently treating. Assuming this value is correct, the system performs very well on this type of waste stream.

Typical sludge removal systems require large land areas for settling ponds and/or expensive clarifiers, thickeners, filter presses, etc. If the CST system, including the treatment module and sludge removal system, performs as well on other waste streams as it reportedly does on the iron-rich stream, then it should be able to compete favorably with typical treatment systems.

Patent Integrity

The CST patent, which covers the treatment module and does not include the sludge collection system, has been reviewed by POWER.

It should be clearly understood that this review was performed by technical and not legal personnel. As a result, it consists purely of the perceptions and opinions of the engineers performing the review. The intent of this review is to consider the integrity of the CST patent and offer opinions as to whether the underlying process and equipment is unique and therefore cannot be copied or duplicated without patent infringement.

The basic patent addresses the simultaneous introduction of a neutralizing agent and an oxidant into an agitated zone resulting in an "instantaneous elevation of pH" and further states that this results in the reaction time being greatly reduced and thus "the equipment required is small, compact and easily transportable." This is accomplished in a reaction vessel and uses an aerator motor and pH control system.

No treatment systems which exactly duplicated the CST system were found. References to this type of approach were made in various literature sources, however. One reference (1), which addresses the design of iron and manganese removal systems, states that an oxidation system which involves pH adjustment is a basic approach to removal of these constituents. A figure illustrating the design of such a system shows untreated water being fed to a vessel with an agitator and then to a detention tank. "Chemical injection" is also shown as occurring at the tank with the agitator. Although this is not precisely what is being done in the CST system, it appears to be very similar and could be used as justification for a competitor to build their own packaged treatment system, possibly using separate reaction and detention tanks, and avoid patent infringement. It should also be noted that this reference predates the patent by three years.

Using pH adjustment (with lime, caustic, CO_3 , or HCO_3) and addition of an oxidizer (oxygen from air, pure oxygen, ozone, hydrogen peroxide, chlorine, et al) to remove heavy metals is also discussed in other literature references (2). Therefore, it would seem apparent that the approach the CST module uses for the removal of heavy metals is not unique, although precisely how it is done may be unique.

The overall impression of this reviewer is that the patent could be circumvented relatively easily by competitors. However, if PG&E Operating Services chooses to invest in CST, it would be possible to minimize the negative impact of competitors marketing essentially the same system. The CST system is already developed and

ready for the marketplace (although it has not yet been field-tested on many heavy metals).

Assuming a market for this type of treatment system exists, an aggressive marketing strategy would allow the CST system to become established in the marketplace before the potential competitors could react by developing systems of their own. Also, it might be possible to extend this grace period by appropriate "saber rattling" over the defense of the CST patent by the company attorneys.

1. James M. Montgomery, *Water Treatment Principles and Design*, John Wiley & Sons, New York, 1985.
2. Corbitt, Robert A., *Standard Handbook of Environmental Engineering*, McGraw-Hill, New York, 1989.

RAW MATERIAL SOURCES AND AVAILABILITY

Although a small quantity of flocculent is also used, the primary reagent fed to the CST system is caustic (sodium hydroxide). If widespread sales of these units occur, the demand for caustic would increase and the supply and/or price could be adversely affected. Therefore, POWER has reviewed the cost and availability of caustic in an attempt to define the potential risk associated with this feedstock.

In the past few decades, caustic has primarily been co-produced with chlorine from sodium chloride. In recent years, the demand for chlorine has declined as various chlorine consumers such as the chlorofluorocarbons and chlorinated insecticides industries have fallen into disrepute. This has resulted in tight caustic supplies and higher prices. As an example, in the past few years the price of caustic has increased from \$90/ton to over \$300/ton in some areas.

The strong demand and increased prices for caustic was recognized by the soda ash (sodium carbonate) industry as an opportunity and it has responded accordingly. The soda ash industry, which recognized that the reaction of soda ash and calcium oxide produces calcium carbonate and caustic, has recently entered into the business of caustic production.

In the western United States, the soda ash industry is primarily located in southwestern Wyoming near Rock Springs (although there is a plant near Trona, California, also). Producers in the Rock Springs area include FMC, Tenneco, Stauffer, General Chemical, and Tg Soda Ash. Of these, FMC started up a 65,000 ton/year unit this spring, Tenneco recently broke ground on a similar sized unit, and Tg Soda Ash is awaiting management approval of an AFE for a 150,000 ton/year unit. General Chemical's and Stauffer's plans are unknown. If demand warrants and the price remains high, additional capacity could be added by some or all of these soda ash producers. Therefore, it is felt that a relatively secure source of caustic exists and its use is a matter of economics.

One soda ash producer, who was felt to be representative, stated that a 50% caustic solution would be sold, FOB their plant, in the \$250-320/dry ton range. They further stated that for a long term contract, a price in the \$220/ton range would be reasonable.

COMPETITION

Treatment technologies in competition with the CST system fall into two general categories. One includes systems which utilize similar physiochemical processes, and the other includes systems which are based on various other processes. The first category, which includes the CST system, basically uses chemical precipitation and physical separation as the basis for heavy metals removal. The second category includes systems which employ ion exchange, reverse osmosis, and activated carbon adsorption.

Chemical Precipitation Systems

Chemical precipitation systems, by definition, use a reagent which modifies the pH and reacts with the metals to form a precipitate. Typical precipitating agents include lime, caustic, and sulfides. These can be used in combination with oxidizing or reducing agents to reduce toxicity or solubility, or transform a substance into a more easily handled form.

The primary advantages of lime precipitation systems are that the lime is relatively inexpensive, about \$90/ton, readily available, and that the systems are widely known and accepted. The advantage of the low lime cost is somewhat negated by the fact that ratios as high as 4:1 over stoichiometry are typically used to provide an adequate reagent concentration. Other disadvantages of lime systems include: slow reaction kinetics and subsequent large holdups to provide residence time, large settling ponds for sludge collection, generation of large volumes of sludge compared to systems based on other reagents, and generation of a sludge which is generally not desirable for reclamation.

Caustic is more expensive than lime, although with the nearly stoichiometric reagent addition used by the CST system, the reagent cost penalty is minimal (with low cost caustic, the advantage will actually be with the caustic system), there is a much smaller quantity of sludge generated, and the sludge is more likely to be suitable for reclamation.

The primary advantage of systems using sulfides, which are much less common than lime systems, is that many heavy metals will react to form a compound with much lower solubility and thus provide for lower concentrations of heavy metals in the treated stream. As an example, at approximately pH 9.7, lead sulfide, which might be formed with a sulfide precipitation system, solubility is less than 10^{-6} mg/l while lead hydroxide solubility is greater than 10 mg/l. While this is an extreme case, other metals follow this same trend.

Oxidation

Oxidation is used in the CST system to enhance the reaction kinetics of the precipitation system. Oxidation is used in cyanide treatment systems to transform the sodium cyanide into non-toxic sodium salts. As pH control is critical to this process to ensure that cyanide gas is not emitted, the accurate pH control offered by the CST system used in conjunction with a strong oxidizer such as ozone, chlorine or hydrogen peroxide would seem an ideal way to neutralize cyanide. This appears to be an excellent potential market for CST units.

P006440

Reduction

Chemical reduction is primarily used for treatment of wastes containing lead, mercury, or hexavalent chromium, using reducing agents such as sulfur dioxide, sulfite salts, and ferrous sulfate. With hexavalent chromium, the oxidation state is first changed using a reducing agent in an acidic medium to produce trivalent chromium which is then precipitated under basic conditions. It is theorized that two CST units in series could perform these two process steps to remove hexavalent chromium.

Ion Exchange

In ion exchange systems, heavy metals are removed by passing the waste stream through an ion exchange resin bed and exchanging the heavy metal ions for innocuous ions which are on the surface of the resin. This is a relatively simple system which works well to treat small streams with low concentrations of metals under certain conditions. The ion exchange system design must be sensitive to the specific metals to be removed, suspended solids must be controlled to prevent bed plugging, and precipitation reactions which could also plug the bed must be avoided. The beds must be periodically regenerated to restore the ion exchange sites and the wastes from this process, which include the heavy metals originally removed, must be dealt with in some manner.

Although ion exchange units are used to remove heavy metals in certain circumstances, it is not anticipated that they would be in direct competition with CST systems in most instances.

Reverse Osmosis

Reverse osmosis is a membrane filtration process which, although primarily used to improve the quality of brackish water, can be used to remove heavy metals. However, due to susceptibility of the membrane to damage, high capital costs, and the requirement that a highly concentrated residual stream be dealt with, the applicability of reverse osmosis as a means of removing heavy metals is limited.

Carbon Adsorption

Carbon adsorption, in which an ion is adsorbed onto the surface of a carbon particle as the waste stream is passed through a carbon bed, can also be used to remove heavy metals. Commercial applications for heavy metals treatment are also anticipated to be quite limited due to the variability of the removal efficiencies, long contact times required, and necessity of regenerating or disposing of the spent carbon.

P006441

MARKET POTENTIAL

Per PG&E Operating Services' verbal direction, the original proposed scope of this investigation, which was to perform a broad-based market assessment, was modified to focus primarily on the mining industry. Accordingly, POWER has confidentially discussed this technology and its potential applications with mining industry personnel and regulators who deal with the mining industry to ascertain their interest and thoughts for its market potential.

Much emphasis today is placed on precious metals mining (gold and silver) where cyanide is used to extract the metal values from the ore. Process waters are kept at pH levels typically above 10.5. Even in the base metals industry (copper-lead-zinc, etc.), process waters are relatively neutral with pH levels around 7.0. Copper metal mining producers often employ process circuits for high sulfide ores to produce acid as a by-product for commercial sale. In processes where acid is employed and waste waters may be present for treatment, the industry is bound by law through Federal regulations and is not allowed to discharge at all. Treatment, where necessary, is typically done by evaporation in holding ponds with some pH control by lime treatment. In most cases, process waters are recirculated.

Direct application appears limited for use of treating acidic waste waters in the present day mining/processing industry, since mining companies are very unlikely to undertake large-scale treatment programs until such programs are required by government regulations and the regulations are effectively enforced.

There appears to be one potential market area within the minerals industry, although the development time-lines for this market area could be long. Acid drainage problems associated with mining operations listed on the Superfund Clean-up list are well documented. Several sites of interest would include:

- Yak Tunnel Project, owned by ASARCO, located in Leadville, Colorado
- Red Mountain Property, owned by Cornucopia Resources, located in Ouray, Colorado
- Butte-Anaconda, Clark Fork River Operations, ARCO Minerals, Butte and Anaconda, Montana.
- Bitter Creek Project, owned by Phelps Dodge, located in Jerome, Arizona
- Pinal Creek Project, owned by Cyprus Minerals, located near Globe, Arizona

Most of these sites have been well studied, but the time involved in developing practical solutions, along with the political realities and associated costs, have delayed much of the clean-up work. At Butte, Montana, acid water volumes associated with the Berkley pit are staggering. The costs of disposal treatment have been estimated at hundreds of millions of dollars. No real solutions have been developed to date. Both ARCO Minerals (Anaconda Minerals) and the EPA continue to study the problem.

In addition to the applications noted above, POWER has identified some near-term prospects for using a variation of the CST technology to treat cyanide-bearing waste process waters from gold and silver mining operations. Since the need is apparent, the money is available, and the potential market is very large, we have discussed this application in the following separate section, "Alternative Mining Industry Applications."

CHEMICAL SEPARATION TECHNOLOGY EVALUATION

PART III -- ALTERNATIVE MINING INDUSTRY APPLICATIONS

New Target Application

After confidentially discussing the CST system with operators within the minerals industry, POWER has identified a potential pioneer application for the CST system. It is apparent that the technology could be employed to handle a real problem specific to the gold mining and processing industry. There are significant short and long term cost liabilities associated with the disposal of cyanide-bearing waste process waters. Most gold operations throughout the country have routine but short-term problems with wildlife being poisoned by cyanide present either within tailings impoundments, water holding ponds and/or heap leach ore piles. Strict state and federal standards have been established and violators are fined for excursions over the allowed limits of mammal and avian kills. Public concern has significantly grown over the past few years. National and local environmental groups who monitor the mining industry have managed to create physical and monetary road blocks to mine development.

Perhaps the most critical area of concern is that of the long-term liabilities of cyanide retained in large volumes of waste heap-leached rock, tailings materials and spent process water holding ponds. State and federal regulators, as well as environmental groups, are very concerned about the long-term affects of cyanide being leached into ground water resources. Newmont Gold's operations in Nevada, as well as many others, have been targeted by major environmental organizations. Placer Dome's operations in Montana and Newmont's Carlin operations in Nevada were subject of concern and debate during 1989 on the television program "20/20."

In short, the detoxification of cyanide is a heated subject as well as a costly item for the gold mine operator, who now may spend from \$0.08 to \$0.52 per ton of ore to treat cyanide in tailings materials prior to impoundment. For operations such as those run by Placer Dome, Newmont, Echo Bay Mines, Pegasus, Barrick and Amax, the overall costs to treat cyanide is significant. For example, Echo Bay's operations in Nevada, including McCoy/Cove, Round Mountain, Borealis and Alta Bay, report approximately 320,000,000 tons of in-ground reserves. At \$0.08 per ton or the low end of the treatment cost scale, they will spend approximately \$25,600,000 in cyanide detoxification over the life of the mine operations. I would estimate that Echo Bay is now spending roughly \$600,000 to \$1,000,000 per year to address this issue. Ironically, after operations are completed, they will still need to address the primary concern, the long-term ground water liability and associated clean-up issues.

Process Changes

Based on the basic CST system design and its rapid ability to neutralize acidic waste waters, there appears to be no reason why the system would not work in the oxidation treatment of cyanide. Depending upon the system's application, modifications would be needed, especially where waste streams of high percent solids (30-50%) are to be treated. Oxidizers such as hydrogen peroxide, ferric sulfate, ozone, and chlorine could be used. Specific modification recommendations could be made after further evaluation of the equipment design, in the light of present industry approaches and applications.

P006443

Market Approach

Two areas of cyanide treatment within the gold processing industry should be more thoroughly examined including:

- Tailings cyanide detoxification including waste streams having 30 percent solids and greater.
- Barren process waters from heap leach operations or clarified waste waters from tailings impoundment.

Marketing the modified CST system as a unit to be operated by the industry is one approach. However, establishing a clean-up company specific to cyanide detoxification in tailings materials, heap leach waste piles and/or barren process leach solutions in storage would appear to be more beneficial to the industry, and perhaps, more lucrative. If the technology could be applied whereby treatment costs were lowered as opposed to the specific cost of clean-up by the operator, then a niche might be established.

Considering the large quantities of material to be handled and treated, and the present costs per unit (\$0.08 to \$0.52 per ton) of treatment, the approach could represent long-term cash income to the new company operator. However, a big question to be considered in this approach is the "placement of liability" after decommissioning of a site. The new company should approach the clean-up problem with a clear understanding with the owner that the liability is the owner's. This approach does seem to work for companies such as Groundwater Technology, Inc., which specializes in ground water testing and treatment.

Large operators with significant reserves and low operating costs should be targeted. POWER's contacts for this document included the following:

- Pegasus Gold
- Echo Bay Minerals
- Barrick Goldstrike
- Meridian Gold
- Placer Dome

The following companies should also be considered:

- AMAX Gold
- Noranda
- FMC
- Inco (American Copper and Nickel)
- Homestake
- Battle Mountain Gold
- Gold Fields
- BP/Kennecott
- Phelps Dodge

P006444

EXHIBIT 6

AGREEMENT NO. 161658

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

EXECUTED COPY

TABLE OF CONTENTS

<u>ARTICLE</u>	<u>TITLE OF ARTICLE</u>	<u>PAGE</u>
I	SCOPE OF WORK	1
II	TERM	2
III	PAYMENT	2
IV	GENERAL PROVISIONS	4
V	NOTICES	4
VI	AUTHORIZATION FOR CHANGES AND APPROVALS	4
VII	DISCLOSURE OF HAZARDOUS SUBSTANCES	5
VIII	REPRESENTATIONS	6
IX	ENTIRE AGREEMENT	6

EXHIBIT

66

DEPOSITION
EXHIBIT

D-66
4c 5/26/00

CST 1943

AGREEMENT NO. 161653
BETWEEN
OWNERS
AND
CHEMICAL SEPARATION TECHNOLOGY, INC.

THIS AGREEMENT, entered into the 5TH day of *February* 1988, between PENNSYLVANIA ELECTRIC COMPANY for the Keystone Station Owners: Atlantic City Electric Company, Baltimore Gas & Electric Company, Delmarva Power & Light Company, Jersey Central Power and Light Company, Pennsylvania Power & Light Company, Philadelphia Electric Company, and Public Service Electric & Gas Company (hereinafter referred to as "Owners") and CHEMICAL SEPARATION TECHNOLOGY, INC. (hereinafter referred to as "Contractor"), intending to be legally bound, agree as follows:

AGREEMENT SCHEDULE

ARTICLE I - SCOPE OF WORK

- A. Contractor shall provide all labor, supervision, equipment, material, parts and insurance necessary to perform required technical service and maintenance on Chemical Separation Technology's mobile caustic treatment unit.
- B. The Contractor shall test, evaluate and develop new methods and procedures for the treatment of waste waters in an environmentally safe and economic manner.

8. Contractor hereby agrees to perform this work as may be authorized by the Owners via work releases issued to the Contractor, from time to time, by the Owners' technical representative. The Contractor understands that the Owners do not promise or warrant the amount of or that any such work will be required hereunder.

ARTICLE II - TERM

The term of this Agreement shall be entered into the date hereof, and shall continue through January 14, 1989.

ARTICLE III - PAYMENT

- A. Contractor shall be paid in accordance with the ATTACHMENT I - RATE SCHEDULE for work performed as set forth in ARTICLE I - SCOPE OF WORK; except that, in no event shall the Contractor be entitled to payments in excess of \$25,000.00, which is hereby established as the Ceiling Price authorized for such work, and subject to the following conditions:
1. Owners shall not be obligated to pay the Contractor in excess of the above stated Ceiling Price and the Contractor shall not be obligated to continue performance of the work under the contract unless and until the Owners shall have notified the Contractor by an amendment hereto that the Ceiling Price has been increased.
 2. Daily time sheets shall be submitted to the Owners' designated technical representative for review and signature. The Contractor also shall submit additional supporting documentation as deemed to be necessary by the Owners.
 3. Contractor's records, insofar as they pertain to billings to the Owners or to disbursements made to the Owners' account for the services provided hereunder, shall be maintained in accordance with generally accepted accounting practice and shall be open to the Owners

inspection and audit, upon reasonable prior notice and during normal business hours, for three (3) years after the calendar year in which the services to which they pertain were rendered or the disbursements were made. The Contractor shall make appropriate adjustments as may be required to reflect the results of such inspection and audit.

4. The Contractor agrees that any refunds, rebates, credits, or other amounts (including any interest thereon) accruing to or received by the Contractor, or any assignee under this Agreement, shall be paid by the Contractor to the Owners, to the extent that they are properly allocable to costs for which the Contractor is reimbursed by the Owners under this Agreement.

- B. Contractor shall submit separately one (1) invoice per thirty (30) day period for work performed. Each invoice must include the following:

- a. Contractor's name and address
- b. Agreement No. 161658
- c. Contract Item No. 1
- d. Inclusive dates of performance covered by the invoice

In addition, each invoice must be accompanied by a detailed work completion statement showing, at a minimum, the hours of labor worked (by classification), materials supplied, if any, including copies of all material invoices, allowable out-of-pocket expenses, if any, including supporting documentation, and subcontract expenses, if any, including copies of all subcontractor invoices.

- C. Terms of payment shall be NET 30 DAYS after receipt of proper invoices at the Owners' payment office.

ARTICLE IV - GENERAL PROVISIONS

The terms and conditions contained in the General Provisions Fixed Price - Maintenance, revised July 31, 1987, attached hereto and made part of this Agreement, shall apply to all services performed under this Agreement.

Wherever in the General Provisions the term "Penelec" appears, it shall mean "Owners".

ARTICLE V - NOTICES

Any notice required under this Agreement shall be deemed to have been given at the time it is received in writing by the party being notified. The parties authorized to give and receive such notices are as follows:

1. For the Owners:

Mr. N. H. George
Administrator III - Contracts
Pennsylvania Electric Company
1001 Broad Street
Johnstown, PA 15907

2. For the Contractor:

Mr. S. M. Stevenson
President
Chemical Separation Technology, Inc.
1700 Painter's Run Road
Pittsburgh, PA 15243

ARTICLE VI - AUTHORIZATION FOR CHANGES AND APPROVALS

A. No changes or amendments to this Agreement are authorized unless made by the Owners' representatives designated by name in paragraph B of this ARTICLE VI and substantiated by formal written direction or amendment hereto. Changes made by the Contractor, unless authorized in advance by such formal written direction or amendment, shall be made at the sole risk of the Contractor.

B. Representatives designated below are the only persons authorized to bind the Owners contractually under this Agreement, including any written direction or amendment hereto:

CST 1947

1. Mr. N. H. George, Administrator III - Contracts
Pennsylvania Electric Company
2. Mr. T. E. Swain, Staff Administrator-Contracts
Pennsylvania Electric Company
3. Mr. J. W. Milburn, Manager-Contracts III
Pennsylvania Electric Company
4. Mr. G. J. Bennett, Director of Procurement
Pennsylvania Electric Company
5. Mr. H. M. Class, Jr., Vice President - Materials and Services
Pennsylvania Electric Company

ARTICLE VII - DISCLOSURE OF HAZARDOUS SUBSTANCES

If the Contractor's duties, as hereinbefore described, include the supply of "hazardous substances," as that term is used under the Worker and Community Right-to-Know Act, the Contractor shall promptly furnish written notice to Owners' Corporate Safety Department, 1001 Broad Street, Johnstown, Pennsylvania, 15907, if any substance to be brought onto Owners premises by the Contractor has been listed by the Pennsylvania Department of Labor and Industry as a "hazardous substance." The Contractor shall retain, at the jobsite, a copy of the Material Safety Data Sheet for all such "hazardous substances" and shall make all such MSDS's available to Owners upon Owners' request at all times during the performance of the work. In addition, the Contractor shall accurately label all containers which are furnished by the Contractor naming the substance, warning of the hazard, and indicating the Contractor's name, address, and telephone number.

ARTICLE VIII - REPRESENTATIONS

This Agreement is signed by Pennsylvania Electric Company on behalf of the Keystone Station Owners: Atlantic City Electric Company, Baltimore Gas & Electric Company, Delmarva Power & Light Company, Jersey Central Power and Light Company, Pennsylvania Power & Light Company, Philadelphia Electric Company, and Public Service Electric & Gas Company, owners of undivided

interest in the Keystone Station. The Owners' interests and obligations hereunder shall be and remain several; and not joint, equal to the percentages of undivided ownership in the Keystone Station.

Pennsylvania Electric Company represents that it has the authority to execute this Agreement on behalf of the Owners, and to execute all changes or amendments hereto, in a like manner. Pennsylvania Electric Company shall have no liability for performance of this Agreement. However, it is hereby agreed that all covenants of indemnification flowing from the Contractor to the Owners hereunder shall also inure to the benefit of Pennsylvania Electric Company.

ARTICLE IX - ENTIRE AGREEMENT

This Agreement constitutes the entire agreement between the Owners and the Contractor. It supersedes all prior or contemporaneous communications, representations, or agreements, whether oral or written, with respect to the subject matter hereof and has been induced by no representations, statements, or agreements other than those herein expressed.

WITNESS:

CHBICAL SEPARATION TECHNOLOGY, INC.

[Signature]

By

[Signature]

Date:

2/5/88

WITNESS:

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

[Signature]

By

[Signature]

Date:

2/5/88

RATE SCHEDULE

Labor (The rates below pertain to ARTICLE I - SCOPE OF WORK, paragraph A only)

	<u>Straight</u>	<u>1 1/2 Time</u>	<u>Double Time</u>
Technician	\$35.00	\$43.00	\$57.00

Labor (The rates below pertain to ARTICLE I - SCOPE OF WORK, paragraph B only, and are subject to a multiplier of 2.0)

Principal and Staff Consultant	\$22.00-35.00/Hour
Project Manager	\$17.00-25.00/Hour
Project Engineer, Senior Staff Engineer, and Senior Chemist	\$15.00-21.00/Hour
Lead Engineer, Staff Engineer, and Chemist	\$13.00-19.00/Hour
Senior Engineer, Designer, and Laboratory Technician	\$11.00-17.00/Hour
Engineer, Designer, and Laboratory Technician	\$ 9.00-13.00/Hour
Senior Draftsman and Technician	\$ 8.00-12.00/Hour
Draftsman and Technician	\$ 4.00- 8.00/Hour
Clerical and Typist	\$ 3.50- 7.50/Hour

Material - cost plus 10%

Travel Expenses - \$50.00 per person/per day/vehicle

Subsistence - \$22.00 per person/per day plus direct cost of lodging x 10% surcharge

Mileage - \$50.00 vehicle/day or \$.32/mile if actual mileage exceeds daily rental rates

EXECUTED COPY

AMENDMENT NO. 1

TO

AGREEMENT NO. 161658

BETWEEN

OWNERS

AND

EXECUTED COPY

CHEMICAL SEPARATION TECHNOLOGY, INC.

The purpose of this Amendment is to increase funding.

Effective 12/20/88, Agreement No. 161658 is hereby amended and Contractor agrees as follows:

1. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$30,000.00, an increase of \$5,000.00.

All other terms and conditions of Agreement No. 161658, as amended, remain in full force and effect.

WITNESS:

CHEMICAL SEPARATION TECHNOLOGY, INC.

Don M. Stenerson

By

Date: 12/19/88

WITNESS

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

Debbie Adams

By

Date: 12/20/88

5336m-99

CST 1951

EXCUTED COPY

EXCUTED COPY

AMENDMENT NO. 2

TO

AGREEMENT NO. 161658

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

The purpose of this Amendment is to extend the term and increase funding.

Effective 2/1/89, Agreement No. 161658 is hereby amended and Contractor agrees as follows:

1. ARTICLE II - TERM

Extend the expiration date to January 31, 1989.

2. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$30,000.00, an increase of \$5,000.00.

All other terms and conditions of Agreement No. 161658, as amended, remain in full force and effect.

WITNESS:

CHEMICAL SEPARATION TECHNOLOGY, INC.

Diane M. Stenhouse

By

Date: 1/30/89

WITNESS

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

J. Matthews

By

Date: 2/1/89

EXECUTED COPY

AMENDMENT NO. 3

TO

AGREEMENT NO. 161658

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

EXECUTED COPY

The purpose of this Amendment is to extend the term and increase funding.

Effective 3/20/89, Agreement No. 161658 is hereby amended and Contractor agrees as follows:

1. ARTICLE II - TERM

Extend the expiration date of the Agreement to January 31, 1990.

2. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$62,000.00, an increase of \$25,000.00.

3. ATTACHMENT I - RATE SCHEDULE

Existing rates shall be firm through January 31, 1990.

All other terms and conditions of Agreement No. 161658, as amended, remain in full force and effect.

WITNESS:

Daniel M. Stencus

CHEMICAL SEPARATION TECHNOLOGY, INC.

By [Signature]

Date: 3/16/89

WITNESS

[Signature]

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

By [Signature]

Date: 3/20/89

AMENDMENT NO. 4
TO
AGREEMENT NO. 161658
BETWEEN
OWNERS
AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

The purpose of this Amendment is to increase the Scope of Work, modify the term, increase funding and modify the rate schedule.

Effective April 28, 1989, Agreement No. 161658 is hereby amended and Contractor agrees as follows:

1. ARTICLE I - SCOPE OF WORK

Add as Paragraph A.1:

A.1 Contractor shall provide emergency rental equipment and labor for the treatment and dewatering of sludges generated at the East Valley Disposal Site (Keystone Station) in order to maintain environmental compliance. Work shall be performed in accordance with the attached Contractor's letter of April 19, 1989, except as modified herein.

2. ARTICLE II - TERM

Extend the expiration date of the Agreement to January 31, 1991.

3. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$447,000.00, an increase of \$385,000.00.

4. ATTACHMENT I - RATE SCHEDULE

Add the following:

"The rates below pertain to Article I - Scope of Work, Paragraph A.1, only:

CST 1954

EXECUTED COPY

AMENDMENT NO. 5

TO

AGREEMENT NO. 161658

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

EXECUTED COPY

The purpose of this Amendment is to add to the rate schedule.

Effective 8/14/89, Agreement No. 161658 is hereby amended and Contractor agrees as follows:

1. ATTACHMENT I - RATE SCHEDULE

Add the following overtime rates for Operator:

Time and 1/2 \$37.00/hour

Applies to all hours worked in excess of forty (40) hours/week and all hours worked on Saturday

Doubletime \$49.00/hour

Applies to all hours worked on Sundays and Holidays

All other terms and conditions of Agreement No. 161658, as amended, remain in full force and effect.

WITNESS:

CHEMICAL SEPARATION TECHNOLOGY, INC.

[Signature]

By
Date:

[Signature] 8/9/89

WITNESS

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

[Signature]
5336m-98

By
Date:

[Signature]
8/14/89

CST 1956

EXECUTED COPY

EXECUTED COPY

AGREEMENT NO. 0307981
BETWEEN
OWNERS
AND
CHEMICAL SEPARATION TECHNOLOGY, INC.

TABLE OF CONTENTS

<u>ARTICLE</u>	<u>TITLE OF ARTICLE</u>	<u>PAGE</u>
I	SCOPE OF WORK	1
II	TERM	2
III	PAYMENT	2
IV	GENERAL PROVISIONS	4
V	FURNISHED PROPERTY	5
VI	NOTICES	5
VII	AUTHORIZATION FOR CHANGES AND APPROVALS	5
VIII	DISCLOSURE OF HAZARDOUS SUBSTANCES	6
IX	WASTE DISPOSAL	7
X	REPRESENTATIONS	7
XI	ENTIRE AGREEMENT	8

CST 1957

AGREEMENT NO. 0307981
BETWEEN
OWNERS
AND
CHEMICAL SEPARATION TECHNOLOGY, INC.

THIS AGREEMENT, entered into the 25th day of *January* 1991, between PENNSYLVANIA ELECTRIC COMPANY for the Keystone Station Owners: Atlantic City Electric Company, Baltimore Gas & Electric Company, Delmarva Power & Light Company, Jersey Central Power and Light Company, Pennsylvania Power & Light Company, Philadelphia Electric Company, and Public Service Electric & Gas Company (hereinafter referred to as "Owners" as noted in Article entitled "Representations") and CHEMICAL SEPARATION TECHNOLOGY, INC. (hereinafter referred to as "Contractors"), intending to be legally bound, agree as follows:

AGREEMENT SCHEDULE

ARTICLE I - SCOPE OF WORK

- A. Contractor shall provide all engineering and technical services, supervision, equipment, materials, parts and supplies necessary to maintain and improve the Chemical Separation Technology's mobile caustic treatment unit and to test, evaluate and develop new methods and procedures for the treatment of waste waters in an environmentally safe and economic manner.

Contractor shall also provide emergency rental equipment and labor for the treatment and dewatering of sludges generated at the East Valley Disposal Site (Keystone Station) in order to maintain environmental compliance.

- B. Contractor hereby agrees to perform this work as may be authorized by the Owners via work releases issued to the Contractor, from time to time, by the Owners' technical representative. The Contractor understands and agrees that the Owners do not promise or warrant the amount of or that any such work will be required hereunder and that this is not an exclusive requirement's contract and the Owners may, at their discretion, enter into other contracts with other contractors for such work.

ARTICLE II - TERM

The term of this Agreement shall commence on February 1, 1991 and shall continue through January 31, 1993 for performance of work set forth in

ARTICLE I - SCOPE OF WORK.

ARTICLE III - PAYMENT

- A. Contractor shall be paid in accordance with the ATTACHMENT I - RATE SCHEDULE for work performed as set forth in ARTICLE I - SCOPE OF WORK; except that, in no event shall the Contractor be entitled to payments in excess of \$250,000.00, which is hereby established as the Ceiling Price authorized for such work, and subject to the following conditions:

1. Owners shall not be obligated to pay the Contractor in excess of the above stated Ceiling Price and the Contractor shall not be obligated to continue performance of work under the contract unless and until the Owners shall have notified the Contractor by an amendment hereto that the Ceiling Price has been increased.

2. Daily time sheets for on-site work shall be submitted to the Owners' designated technical representative for review and signature. Time sheets for shop work (if applicable) shall be provided to the Owners' designated technical representative for review as supporting documentation of Contractor invoicing. The Contractor also shall submit additional supporting documentation as deemed to be necessary by the Owners.
 3. Contractor's records, insofar as they pertain to billings to the Owners or to disbursements made to the Owners' account for the services provided hereunder, shall be maintained in accordance with generally accepted accounting practice and shall be open to the Owners inspection and audit, upon reasonable prior notice and during normal business hours, for three (3) years after the calendar year in which the services to which they pertain were rendered or the disbursements were made. The Contractor shall make appropriate adjustments and refund Penelec any overcharges as may be required to reflect the results of such inspection and audit.
 4. The Contractor agrees that any refunds, rebates, credits, or other amounts (including any interest thereon) accruing to or received by the Contractor, or any assignee under this Agreement, shall be paid by the Contractor to the Owners, to the extent that they are properly allocable to costs for which the Contractor is reimbursed by Owners under this Agreement.
- B. 1. Contractor shall submit separately one (1) invoice per thirty (30) day period for work performed. Each invoice must include the following:
- a. Contractor's name and address
 - b. Agreement No. 0307981

c. Contract Item No. 1

d. Inclusive dates of performance covered by the invoice

The above contract item number is for the Owners internal use and does not alter the scope of work set forth in ARTICLE I - SCOPE OF WORK.

B. 2. Each invoice must be accompanied by detailed back-up documentation supporting all charges authorized by this Agreement such as:

a. Timesheets supporting the hours of labor worked by classification.

b. Timesheets supporting equipment rental usage.

c. Allowable out-of-pocket expenses including supporting documentation.

d. Subcontractor expenses, if authorized by the Owners, shall include copies of all timesheets as supporting documentation.

Labor charges or equipment rental charges, including subcontractor expenses, shall be invoiced not-to-exceed the all-inclusive rates set forth in the rate schedule(s). Expense receipts are not required for out-of-pocket expenses valued at less than \$25.00 per invoiced line item.

C. Materials (if provided for in this Agreement) must be invoiced in accordance with ATTACHMENT hereto entitled "Rate Schedule - Material".

D. Terms of payment shall be NET 30 days from either the date of invoice receipt of the date of completion/acceptance of work, whichever is later.

ARTICLE IV - GENERAL PROVISIONS

The terms and conditions contained in the General Provisions Fixed Price - Maintenance, revised July 31, 1987, attached hereto and made part of this Agreement, shall apply to all services performed under this Agreement.

Wherever in the General Provisions the term "Penelec" appears, it shall mean "Owners".

CST 1961

ARTICLE V - FURNISHED PROPERTY

Items of property shall be furnished to the Contractor by the Owners in accordance with ARTICLE XXVII - PENELEC-FURNISHED PROPERTY of the General Provisions, as follows:

Description

NONE

ARTICLE VI - NOTICES

Any notice required under this Agreement shall be deemed to have been given at the time it is received in writing by the party being notified. The parties authorized to give and receive such notices are as follows:

1. For the Owners:

Mr. T. E. Swain
Staff Administrator-Contracts
Pennsylvania Electric Company
1001 Broad Street
Johnstown, PA 15907

2. For the Contractor:

Mr. S. M. Stevenson
Vice President
CHEMICAL SEPARATION TECHNOLOGY, INC.
P. O. Box 931
124 Braun Drive
McMurray, PA 15317

ARTICLE VII - AUTHORIZATION FOR CHANGES AND APPROVALS

A. No changes or amendments to this Agreement are authorized unless made by the Owners' representatives designated by name in paragraph B of this ARTICLE VI and substantiated by formal written direction or amendment hereto. Changes made by the Contractor, unless authorized in advance by such formal written direction or amendment, shall be made at the sole risk of the Contractor.

B. Penelec representatives designated below are the only persons authorized to bind the Owners contractually under this Agreement, including any

written direction or amendment hereto:

1. Mr. T. E. Swain, Staff Administrator-Contracts
Pennsylvania Electric Company
2. Mr. T. L. Cherry, Manager-Contracts I
Pennsylvania Electric Company
3. G. A. Landis, Manager-Procurement
Pennsylvania Electric Company
4. Mr. J. W. Milburn, Director-Materials & Services
Pennsylvania Electric Company

ARTICLE VIII - DISCLOSURE OF HAZARDOUS SUBSTANCES

If the Contractor's duties, as hereinbefore described, include the use, production or supply of "hazardous substances," "hazardous chemicals" or other substances subject to regulation under various federal, state or local Right-to-Know or chemical disclosure acts, the Contractor shall comply at all times with all regulations governing such regulated substances. The Contractor's obligations shall include, but shall not be limited to, promptly furnishing written notice to Penelec's Corporate Safety and Health Department, 1001 Broad Street, Johnstown, Pennsylvania, 15907 and to Penelec's designated Technical Representative for this agreement with a list of job specific regulated substances to be brought onto Penelec premises. A copy of the Material Safety Data Sheet for all such hazardous substances must be provided to Penelec's designated Technical Representative prior to the start of work or prior to delivery of such substances onto Penelec premises. At sole discretion of Penelec, Contractor may be denied access to Penelec's site of the work or start of the work may be suspended in the event the Contractor fails to provide the foregoing notice and/or Material Safety Data Sheet(s). In such event, the Contractor shall be fully responsible for any such denied access or suspension and for any delay in the project or increased costs resulting therefrom.

CST 1963

ARTICLE IX - WASTE DISPOSAL

If, during or incidental to the performance of its obligations under this contract, Contractor generates any hazardous waste as identified in Section 3001 of the Resource Conservation Recovery Act or as defined in Section 103 of the Pennsylvania Solid Waste Management Act or releases any hazardous substance as defined in Section 101 of the Federal Comprehensive Environmental Response, Compensation and Liability Act of 1980, or as defined in Section 112 of the Federal Clean Air Act, then it shall be Contractor's sole responsibility to comply with any regulatory requirements applicable to such wastes. The name, location, and PaDER solid waste permit number of the landfill to be utilized shall be submitted to Penelec's Environmental Affairs Department for approval four weeks prior to any waste being shipped to the disposal site. Additionally, in the event the Contractor is required to comply with any manifest requirements, it shall provide a copy of such manifest to Penelec and obtain Penelec's written approval prior to the transportation and/or disposal of such wastes and, provided further, that no later than fifteen (15) days after such wastes have been delivered to a licensed facility for disposal, Contractor shall provide Penelec a written statement setting forth the date, time, place and method of disposal of such wastes.

ARTICLE X - REPRESENTATIONS

For work performed at the following station(s), the term Penelec as used herein and in the attachments hereto shall mean the Owners as identified below:

KEYSTONE STATION

This Agreement is signed by Pennsylvania Electric Company on behalf of the Keystone Station Owners: Atlantic City Electric Company, Baltimore Gas & Electric Company, Delmarva Power & Light Company, Jersey Central Power and Light Company, Pennsylvania Power & Light Company, Philadelphia Electric

Company, and Public Service Electric & Gas Company, owners of undivided interest in the Keystone Station. The Owners' interests and obligations hereunder shall be and remain several, and not joint, equal to the percentages of undivided ownership in the Keystone Station.

Pennsylvania Electric Company represents that it has the authority to execute this Agreement on behalf of the Owners, and to execute all changes or amendments hereto, in a like manner. Pennsylvania Electric Company shall have no liability for performance of this Agreement. However, it is hereby agreed that all covenants of insurance and/or indemnification flowing from the Contractor to the Owners hereunder shall also inure to the benefit of Pennsylvania Electric Company.

ARTICLE XI - ENTIRE AGREEMENT

This Agreement constitutes the entire agreement between the Owners and the Contractor. It supersedes all prior or contemporaneous communications, representations, or agreements, whether oral or written, with respect to the subject matter hereof and has been induced by no representations, statements, or agreements other than those herein expressed.

WITNESS:

CHEMICAL SEPARATION TECHNOLOGY, INC.

Daniel M. Thompson

By 

Date: January 24, 1991

WITNESS:

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

Karol Hughes

By 

Date: 1/25/91

RATE SCHEDULE

A. LABOR

1. The hourly rates for labor as attached hereto are fixed and not subject to adjustment for the term of this Agreement.
2. Overtime (premium time) rates quoted in Item A.1 above are chargeable as follows:

1 1/2 Time

All time after eight (8) hours/day and all Saturdays

Doubletime

All Sundays

Holidays Worked

Premium time shall be paid at the double time rate and will parallel
with Owner's legal holidays

B. Material

See ATTACHMENT I - RATE SCHEDULE - MATERIAL

C. TRAVEL EXPENSES

Offeror proposes the following fixed unit price to cover personnel travel time and all travel and living expenses for each job assignment:

\$ 50.00 /day/person/vehicle

The above price shall be calculated to cover all costs from the contractor's home base of McMurray, PA to the jobsite and return to the Contractor's home base upon release of service.

NOTE: If an out of state employee is required to work the Keystone site their travel expenses shall be cost plus 10%.

D. SUBSISTENCE

The following fixed daily per diem rate per person shall be chargeable only if contractor's personnel actually remains in the vicinity of the jobsite to continue the service the next working day. Overnight stays must be approved by the Owners prior to each work assignment.

\$ 150.00 per person/per day

This per diem shall be all inclusive covering meals, lodging, therefore, local travel expenses and any other costs incurred while assigned.

E. EQUIPMENT (EXCLUDING OPERATOR)

(Specify)	<u>Hourly</u>	<u>Daily</u>	<u>Weekly</u>	<u>Monthly</u>	<u>In/Out Charges</u>
1. <u>One Meter Belt Filter Press</u>	\$ <u>N/A</u>	\$ <u>N/A</u>	\$ <u>N/A</u>	\$ <u>6,000.00*</u>	\$ <u>2,000.00</u>
2. <u>Std Pickup Truck</u>	\$ <u>N/A</u>	\$ <u>50.00</u>	\$ <u>N/A</u>	\$ <u>N/A</u>	\$ <u>N/A</u>
3. _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____

* plus 10% Markup

- The above equipment rates or on separate pages shall be all inclusive and only be charged for actual usage of the equipment plus any mobilization demobilization ("in and out") charges, if applicable. Such rates shall be fixed for the term of this Agreement and shall include all costs for operation, maintenance, fuels, insurance, tolls, licenses, permits and any other costs that normally are included in the cost for equipment. Consumable spare parts and treatment equipment up-grades shall be charged at cost plus 10% markup.
- Billings for equipment shall be based on the lesser of the hourly, daily, weekly or monthly rates depending upon the actual period of use.

Offeror shall complete below and define for equipment rental not included in the firm price or in the all-inclusive hourly rates that may be required for extra work requested..

DAILY (No. of Hours) N/A

WEEKLY (No of Days) N/A

MONTHLY (No. of Days) N/A

ATTACHMENT I - RATE SCHEDULE - LABOR

Date: January 7, 1991

Agreement No. 0307981
RFP No. P679401011
Work Location Keystone

JOB CLASSIFICATION	STRAIGHT TIME	PREMIUM TIME RATE	
		1-1/2 TIME	DOUBLE TIME
1. LABOR - TECHNICAL SERVICE & MAINTENANCE			
Technician - A-1 only	\$37.00/hour	\$45.00/hour	\$59.00/hour
2. LABOR - TESTING, EVALUATION AND DEVELOPMENT			
Invoicing for R & D Services is at a multiplier times the direct payrates for the personnel actually used on the project. multiplier and direct payrate ranges for C.S.T's personnel classifications are shown below. The use of "Engineer" in the titles in the hourly rate also applies to physicists, geologist, environmental specialists, economists, planners and other professional staff members in the same category.			
MULTIPLIER 2.2			
Principal & Staff Consultant	\$22-39/hour	N/A	N/A
Project Manager	\$17-28/hour	N/A	N/A
Project Engineer, Sr Staff			
Engineer, Sr. Chemist	\$15-24/hour	N/A	N/A
Lead Engineer, Staff			
Engineer & Chemist	\$13-22/hour	N/A	N/A
Sr. Engineer, Designer			
Laboratory Technician	\$11-20/hour	N/A	N/A
Engineer, Designer &			
Laboratory Technician	\$12-18/hour	N/A	N/A
Sr Draftsman & Technician	\$ 9-18/hour	N/A	N/A
Draftsman & Technician	\$ 7-12/hour	N/A	N/A
Clerical & Typist	\$ 6-15/hour	N/A	N/A

A-07/89

CST 1968

ATTACHMENT I - RATE SCHEDULE - MATERIAL

Date: December 17, 1990

AGREEMENT NO. 030798:
RFP NO. P679401011
WORK LOC Keystone Station

Contractor Purchased Material:

Invoices for all Materials purchased by Contractor must be supported by sufficient documentation (no documentation is required for material less than \$100.00 total cost per invoiced line item) which indicates the actual price paid by the Contractor. The percent of Mark-Up, as stated below, must be clearly noted and calculated on each invoice for Contractor purchased material. Material supplied by Contractor and/or Contractor's subcontractor/subvendor may not receive a total combined markup greater than the markup for contractor purchased Material stated below.

Percent Mark-Up on Material Purchased 10 % (Freight and taxes shall not be subject to markup.)

Contractor's Inventory Material:

Material provided from Contractor's own inventory (i.e. material which can not be backed up with the actual invoice documenting the actual price paid by the contractor) is to be invoiced at cost (Contractor's inventory cost) with no mark-up. Inventory cost includes the actual price paid plus receiving and handling costs noted below. Contractor shall provide supporting documentation when total material invoiced exceeds \$100.00 total cost per invoiced line item. If supporting documentation is unavailable, Contractor must provide written certification with or on each invoice stating that, "CONTRACTOR CERTIFIES THAT THE COST FOR THESE MATERIALS ARE EQUAL TO OR BETTER THAN THE PRICES CHARGED TO OTHER CUSTOMERS UNDER SIMILAR CIRCUMSTANCES".

Percent inventory Receiving and handling cost over actual price paid by contractor
10 %

Materials Supplied At Current List Price:

Each invoice for Materials supplied at "current list pricing" must be supported, when material invoiced exceed \$100.00 total cost per invoiced line item, with a copy of the applicable current list price sheet(s) highlighting the individual item(s) being invoiced. Additionally, Contractor must supply with or on each invoice written certification stating that, "CONTRACTOR CERTIFIES THAT THE COST FOR THESE MATERIALS ARE EQUAL TO OR BETTER THAN THE PRICES CHARGED TO OTHER CUSTOMERS UNDER SIMILAR CIRCUMSTANCES."

Discount off Current List Price 5 %.

CST 1969

AMENDMENT NO. 1

TO

AGREEMENT NO. 0307981

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INCORPORATED

The purpose of this Amendment is to transfer the right to purchase option from previous Agreement No. 0161658 to this current Agreement.

Effective Oct 28, 1991, Agreement No. 0307981 is hereby amended and Contractor agrees as follows:

1. ARTICLE III - PAYMENT

Add the following:

"E. The purchase option plan for the one (1) Mobile One Meter Trailer Mounted BFP as presented in previous Agreement No. 0161658, Attachment I - Rate Schedule, Item B is hereby transferred and continued in this Agreement.

Should the purchase option be exercised by the Owners, 50% of the rental amount paid under Agreement Nos. 0161658 and 0307981 shall be applied to the purchase price of \$95,000.00 plus 10% Contractor's markup."

All other terms and conditions of Agreement No. 0307981 shall remain in full force and effect.

PAGE 2 OF 2
Amendment No. 1 To
Agreement No. 0307981

WITNESS:

Deane M. Hunsaker

WITNESS:

Karin M. Reed

CHEMICAL SEPARATION TECHNOLOGY,
INCORPORATED

By 

Date: 9/30/91

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

By 

Date: 10/28/91

EXECUTED COPY

EXECUTED COPY

AMENDMENT NO. 2
TO
AGREEMENT NO. 0307981

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

The purpose of this Amendment is to increase funding.

Effective 6/5/92, Agreement No. 0307981 is hereby amended and Contractor agrees as follows:

1. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$495,000.00, an increase of \$245,000.00.

All other terms and conditions of Agreement No. 0307981, as amended, remain in full force and effect.

WITNESS

CHEMICAL SEPARATION TECHNOLOGY,
INC.

Diane M. Stevenson

By [Signature]

Date: 3/11/92

WITNESS

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

Mary Anne King

By [Signature]

Date: 6/5/92

CST 1972

AMENDMENT NO. 3

TO

AGREEMENT NO. 0307981

BETWEEN

OWNERS

AND

CHEMICAL SEPARATION TECHNOLOGY, INC.

The purpose of this Amendment is to increase funding.

Effective 2/24/93, Agreement No. 0307981 is hereby amended and Contractor agrees as follows:

1. ARTICLE III - PAYMENT

Change the Ceiling Price as set forth in paragraph A to \$557,000.00, an increase of \$62,000.00

All other terms and conditions of Agreement No. 0307981, as amended, remain in full force and effect.

WITNESS:

CHEMICAL SEPARATION TECHNOLOGY, INC.

David M. Stevenson

By

Date:

[Signature]
3/10/93

WITNESS:

PENNSYLVANIA ELECTRIC COMPANY
FOR THE KEYSTONE STATION OWNERS

[Signature]

By

Date:

[Signature]
2/24/93

CST 1973

EXHIBIT 7

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

No. : 97-21C

Pages: 1 through 296

Place: Pittsburgh, Pennsylvania

Date: November 13, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20035-4018

(202) 628-4588

hrc@concentric.net

1 MR. KENNY: Your Honor, may Mr. Roth be excused
2 for a minute?

3 THE COURT: Absolutely.

4 MR. KENNY: Thank you, Your Honor.

5 THE COURT: Off the record.

6 (Off the record.)

7 THE COURT: Mr. Elliot, why don't we do this
8 because I think we are probably ready for a five-minute
9 break anyhow. And that will give you a second to pin this
10 down a little bit. So why don't we take a five-minute
11 recess now until 11:30. That clock, by the way, as you
12 probably can tell has not been adjusted for day light
13 savings time. So -- but it is relatively accurate in terms
14 of the minute hand. So let's take a break for about five
15 minutes until 11:30 when we will resume at that time.

16 THE CLERK: All rise.

17 (Whereupon, a brief recess was taken.)

18 THE COURT: Please be seated. All right. Where
19 are we at on this thing, Mr. Elliot?

20 MR. ELLIOT: Okay, Your Honor. Looking at column
21 3 about line 52 --

22 THE COURT: Go ahead.

23 MR. ELLIOT: -- and then continuing, Your Honor,
24 to line 56, I have to agree that just above aerator prop.,
25 if that is the point of injection of the neutralizing agent,

1 then that is sufficiently definite.

2 THE COURT: Okay. Let's move to the second prong
3 of your concerns about this language though, the "generally
4 the same point." We are back on the record, are we not? Go
5 ahead, Mr. Elliot.

6 MR. ELLIOT: Actually, Your Honor, I think so
7 understood that "introducing oxidant at generally the same
8 point at which said neutralizing agent is introduced" would
9 also be definite on that statement.

10 THE COURT: All right. The -- all right. And so
11 this particular set then essentially goes off the table.
12 Correct, Mr. Elliot? Is "generally adjacent", "generally
13 the same point" considered definite?

14 MR. ELLIOT: Yes, Your Honor. Yes, Your Honor.

15 THE COURT: All right. Let's move then to the
16 next one which I have as being at Claim 5. And it is the
17 phrase, "substantially simultaneous" -- excuse me,
18 "substantially simultaneously." Do you want to go ahead and
19 give me your argument on that point, Mr. Elliot? I am
20 right. It is "substantially simultaneously", correct?

21 MR. ELLIOT: Yes, Your Honor. Actually, I guess
22 that our discussion about just above probably resolves that
23 one, too.

24 THE COURT: Okay.

25 MR. ELLIOT: The problem -- the other problem I

EXHIBIT 8

1 BY MR. ELLIOT:

2 Q Under Tab A, do you understand what I mean when I
3 say the 800 patent?

4 A Yes, I do.

5 Q Okay. Looking at the 800 patent, on column 3,
6 line 61, do you see where I am pointing out?

7 A Yes, I do.

8 Q That clause that is labeled A, do you have an
9 understanding of that clause?

10 A Based on the phrasing of the clause, the best
11 understanding that I can make from the statement is that
12 there is going to be an adjustment of the pH. I cannot
13 clearly define based on the phrasing exactly to what pH
14 level that would be.

15 Q Is there anything in your opinion that one skilled
16 in the art would know that would help them to determine what
17 pH to adjust to?

18 A There are several, you know, potential
19 explanations for the numbers shown there. The number 5 and
20 the number 12 could denote a range of pH. We know using
21 kinetics -- oxidation kinetics for ferrous iron that
22 oxidation of ferrous iron increases significantly or as a
23 much more manageable process at about a pH of 5.

24 Q Is there anything in the -- elsewhere in the
25 patent that would lead you to conclude that about 5 has

EXHIBIT 9

UNITED STATES COURT OF FEDERAL CLAIMS

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

)
)
)
)
)
)
)
)
)
)

No.: 97-21C

Volume II

Pages: 264 through 492

Place: Pittsburgh, Pennsylvania

Date: November 16, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20005-4018

(202) 628-4888

hrc@concentric.net

1 he was referring to as the de-watering process --

2 A Yes.

3 Q -- for part of the plant? And you had testified
4 without any reference to any particular time that you had
5 seen such a process. Is that correct?

6 A I'm assuming you mean at Penelec.

7 Q Yes, sir.

8 A Yes, I did.

9 Q How did you see that? Who --

10 A Well, I had visited the site on several occasions
11 to see the operation of the -- of the CST reactor. And
12 there were times when there had to be some adjustments,
13 perhaps adjustment to the pH probe, et cetera. But there
14 were reasons to be at the site to observe the reactor. And
15 at some time after that reactor had been in place, there was
16 a de-watering system that appeared on site.

17 Q Were you involved at all in the development of
18 that de-watering?

19 A No, sir. I wasn't.

20 Q That de-watering process, what was going on, was
21 that in an enclosed building?

22 A It was in a trailer as I recall, a trailer that
23 would be typical for a tractor-trailer type of operation.

24 Q Was it locked up?

25 A I believe on occasions, it was locked. Yes. I'm

1 not sure. But I -- I obviously have seen the device in
2 operation. So it wasn't locked at that time.

3 Q And when you saw the device in operation, was Mr.
4 Stevenson always present with you?

5 A Yes, sir. I believe he was.

6 Q Were you there on his invitation?

7 A Yes, sir.

8 Q And did you understand this was something that Mr.
9 Stevenson was trying to develop?

10 A Well, I understood it to be a process that he was
11 working on at this particular site, certainly different from
12 what we were currently doing at the site.

13 Q Did Mr. Stevenson ever tell you that he wanted you
14 to keep what was going on at the Penelec site, the Keystone
15 site to yourself?

16 A I don't recall exactly, but I'm -- most likely,
17 yes, that would be --

18 Q Well, why do you say most likely?

19 A Well, because of the uniqueness of the -- both the
20 reactor and the de-watering device and our relationship from
21 the CST, whether or not I was still in the company at that
22 time or not. There was the understanding that whatever we
23 did within that group would stay within the group.

24 Q Even though you were no longer a shareholder with
25 CST.

1 A We built a building, put the equipment inside the
2 building. One of the pieces of equipment was on a trailer
3 that was secure. And we incorporated the building into the
4 trailer and put locks and doors on it.

5 Q Was your understanding with all your employees
6 that everything they did and worked on was confidential?

7 A Our employees always signed confidentiality
8 agreements.

9 Q And did you consider your partners and
10 shareholders like Mr. Simonetti and Kanzleiter to also be
11 subject to confidentiality based upon their producer
12 relationship with you and the company?

13 A Yes, sir.

14 Q Now, your patent was granted as noted by Judge
15 Allegra on December 6th, 1994, your 800 patent.

16 A Yes, sir.

17 Q And is it your understanding that once the patent
18 is granted, that the trade secrets involved in that patent
19 are no longer in existence?

20 A Yes, sir.

21 Q They are merged in the patent..

22 A Yes, sir.

23 Q With your particular patent, I just wanted to -- I
24 think these two things were brought up, Mr. Stevenson. With
25 your patent, is it possible to get arsenic removed from

EXHIBIT 10

UNITED STATES COURT OF FEDERAL CLAIMS

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

)
)
)
)
)
)
)
)
)
)

No.: 97-21C

Volume II

Pages: 264 through 492

Place: Pittsburgh, Pennsylvania

Date: November 16, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20005-4018

(202) 628-4888

hrc@concentric.net

1 A We built a building, put the equipment inside the
2 building. One of the pieces of equipment was on a trailer
3 that was secure. And we incorporated the building into the
4 trailer and put locks and doors on it.

5 Q Was your understanding with all your employees
6 that everything they did and worked on was confidential?

7 A Our employees always signed confidentiality
8 agreements.

9 Q And did you consider your partners and
10 shareholders like Mr. Simonetti and Kanzleiter to also be
11 subject to confidentiality based upon their producer
12 relationship with you and the company?

13 A Yes, sir.

14 Q Now, your patent was granted as noted by Judge
15 Allegra on December 6th, 1994, your 800 patent.

16 A Yes, sir.

17 Q And is it your understanding that once the patent
18 is granted, that the trade secrets involved in that patent
19 are no longer in existence?

20 A Yes, sir.

21 Q They are merged in the patent.

22 A Yes, sir.

23 Q With your particular patent, I just wanted to -- I
24 think these two things were brought up, Mr. Stevenson. With
25 your patent, is it possible to get arsenic removed from

EXHIBIT 11

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

No. : 97-21C

VOLUME II

Pages: 264 through 492

Place: Pittsburgh, Pennsylvania

Date: November 16, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20005-4018

(702) 628-4888

hrc@concentric.net

1 waste water?

2 A It is.

3 Q And could you tell the Court how that is done?

4 A In using a ferric or ferrous substance along with
5 that reactor will co-precipitate arsenic for chrome.

6 Ferrous will reduce chrome, to Cr_3 . And it will precipitate
7 out as any other metal along the minimum solubility curves.
8 That means that there is a particular pH set point which is
9 the optimum for solubility in any of those metals.

10 Q So you could remove them with your process then?

11 A I can.

12 Q All right. Now, I want to refer you to Exhibit
13 66.

14 MR. TARASI: I notice, Your Honor, since Mr.
15 Elliot's experienced, I am not bringing these big books all
16 to the rostrum at the same time.

17 BY MR. TARASI:

18 Q Do you have Exhibit 66 in front of you, sir?

19 A I do.

20 Q Now, Exhibit 66 refers to a contract between the
21 owners and Chemical Separation Technology, Inc. Is that
22 correct?

23 A It does.

24 Q Now, if you look at CST1944, the contract is dated
25 the fifth day of February, 1988 between Pennsylvania

1 Electric Company, Keystone Station owners and CST, isn't it,
2 sir?

3 A Yes, it is.

4 Q Note that -- and tell the Court what paragraph B
5 states in that particular page.

6 A It is an open-ended contract where we will -- we
7 were hired to test, evaluate and develop new methods and
8 procedures for water -- for treatment of waste waters in an
9 environmentally safe and economic manner.

10 Q You previously testified on cross examination by
11 Mr. Elliot that you always considered the Keystone Plant to
12 be a place to develop and experiment with your patents, is
13 that right, sir?

14 A That was our laboratory, yes, it was.

15 Q Okay. And then I note that you, again, on the
16 25th of -- let's turn to page CST1958. Do you have that?

17 A Yes, I do, sir.

18 Q And that is dated the 25th -- the agreement is
19 entered between the owners and Chemical Separation
20 Technology, Inc. Is that correct?

21 A Yes, it is.

22 Q Is this agreement entered into the 25th day of
23 January, 1991 between Pennsylvania Electric Company for the
24 Keystone Station owners, and it lists these names, and CST?
25 Isn't that right, sir?

1 A Yes.

2 Q And what does the (A) paragraph say as it spoke of
3 your work?

4 A "Context should provide engineering and technical
5 service, supervision, equipment, materials, parts and
6 supplies necessary to maintain and improve Chemical
7 Separation Technology's mobile caustic treatment unit and
8 test, evaluate and develop new methods and procedures for
9 the treatment of waste waters in an environmentally safe and
10 economic manner."

11 Q And that was your understanding of these contracts
12 that you had with Penelec and Keystone, that you would do
13 this kind of work to develop and -- your new procedures and
14 treatment of waste water? Is that right, sir?

15 A Yes, sir.

16 Q And research in that matter, is that correct?

17 A Yes, sir.

18 Q Mr. Elliot brought out that you were paid certain
19 sums of money in regard to this contract. What was that
20 for?

21 A That was for labor and equipment. Sometimes that
22 money went for other equipment within the plant which had no
23 basis for the test site, but they needed a quick turn-around
24 on equipment in the plant without going through six months
25 of procurement.

EXHIBIT 12

CHEMICAL SEPARATION
TECHNOLOGY, INC.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

No. : 97-21C

VOLUME II

Pages: 264 through 492

Place: Pittsburgh, Pennsylvania

Date: November 16, 2000

HERITAGE REPORTING CORPORATION

Official Reporters

1220 L Street, N.W., Suite 600

Washington, D.C. 20005-4018

(702) 628-4888

hrc@concentric.net

1 Electric Company, Keystone Station owners and CST, isn't it,
2 sir?

3 A Yes, it is.

4 Q Note that -- and tell the Court what paragraph B
5 states in that particular page.

6 A It is an open-ended contract where we will -- we
7 were hired to test, evaluate and develop new methods and
8 procedures for water -- for treatment of waste waters in an
9 environmentally safe and economic manner.

10 Q You previously testified on cross examination by
11 Mr. Elliot that you always considered the Keystone Plant to
12 be a place to develop and experiment with your patents, is
13 that right, sir?

14 A That was our laboratory, yes, it was.

15 Q Okay. And then I note that you, again, on the
16 25th of -- let's turn to page CST1958. Do you have that?

17 A Yes, I do, sir.

18 Q And that is dated the 25th -- the agreement is
19 entered between the owners and Chemical Separation
20 Technology, Inc. Is that correct?

21 A Yes, it is.

22 Q Is this agreement entered into the 25th day of
23 January, 1991 between Pennsylvania Electric Company for the
24 Keystone Station owners, and it lists these names, and CST?
25 Isn't that right, sir?

1 somewhat continuously. But it must be operated in a batch
2 mode. There is a batch element to it regardless of how you
3 operate it.

4 Battery waste -- I have been through some -- and
5 worked for -- on some battery plant waste. They have very
6 low water flows. They reduce the amount of water and the
7 lead for environmental purposes.

8 Q Now, is this patent, in effect, a battery waste
9 treatment patent?

10 A Yes, sir. It is.

11 Q Okay. And you heard Mr. Dupon was questioned, if
12 you wanted to make it a continuous type of operation, what
13 would that take to do it? What size tank? He couldn't seem
14 to calculate it. Can you tell us, what would it be?

15 A That is in reference to if you were trying to
16 treat a waste of 500 gallons per minute which is much, much
17 higher than one would encounter in an acid battery plant.
18 But assuming you had that quantity of waste, you would need
19 approximately 760,000 gallons of tank to treat an equivalent
20 amount to 500,000 -- to 500 gallons per minute as compared
21 to the 0.33 gallons per minute described in the patent.

22 Q As a practical matter, would you have to break
23 down the 730,000 gallon tank into separate other tanks?

24 A Yes, sir. You would have other tanks.

25 Q And would that cover -- what size of area

EXHIBIT 13

United States Patent [19]

Kanzleiter et al.

[11] Patent Number: 4,749,497

[45] Date of Patent: Jun. 7, 1988

[54] METHOD AND APPARATUS FOR
TREATMENT OF ACIDIC WATER

[75] Inventors: Richard S. Kanzleiter; Thomas G.
Simoneetti, both of McMurray;
Kenneth E. Ball, Pittsburgh; Sanford
M. Stevenson, McMurray, all of Pa.

[73] Assignee: Chemical Separation Technology,
Inc., Pittsburgh, Pa.

[21] Appl. No.: 83,525

[22] Filed: Aug. 7, 1987

Related U.S. Application Data

[63] Continuation of Ser. No. 820,955, Jan. 21, 1986, abandoned.

[51] Int. Cl. C02F 1/52; C02F 1/66

[52] U.S. Cl. 210/721; 210/724;
210/738; 210/747; 210/170; 210/208; 210/219;
210/220; 210/241

[58] Field of Search 210/709, 721, 722, 724,
210/738, 758, 747, 170, 205, 208, 219, 220, 241,
907

References Cited

U.S. PATENT DOCUMENTS

1,310,383	7/1919	Auld et al.	252/191
1,364,387	1/1921	Landreth	210/721
2,126,164	8/1938	Anderson	210/758
2,897,150	7/1959	Bencowitz	210/758
3,210,053	10/1965	Boester	210/208
3,541,008	11/1970	Spinola	210/721
3,584,840	6/1971	Fuchs	259/23

3,680,698	8/1972	Liu	210/907
3,715,308	2/1973	Sulfaro	210/758
3,920,552	11/1975	Elkern	210/141
4,021,348	5/1977	Smith	210/208
4,219,418	8/1980	Pilon	210/721
4,267,052	5/1981	Chang	210/208
4,320,012	3/1982	Palm	210/724
4,332,687	6/1982	Daignault	210/721
4,351,720	7/1982	Bailes	210/101
4,526,687	7/1985	Nugent	219/298
4,536,286	8/1985	Nugent	210/208

OTHER PUBLICATIONS

McMillan "pH Titration Curves—Trick or Treat?"
InTech pp. 43-47 (Oct. 1986).

Primary Examiner—Ernest G. Therkorn
Attorney, Agent, or Firm—Arnold G. Silverman; Joyce
L. Morrison

[57] ABSTRACT

A method and apparatus for treating acidic water, such as mine acid water is provided. The apparatus is readily portable and comprises a reaction vessel having an aerator motor operatively associated therewith. Water to be treated is received within said reaction vessel and is treated by having a neutralizing agent and oxidant by way of the aerator motor introduced simultaneously into the system. Because of instantaneous elevation of pH resulting from the simultaneous introduction of oxidant and the neutralizing agent, the reaction time is greatly reduced and the equipment required is small, compact and easily transported.

9 Claims, 2 Drawing Sheets

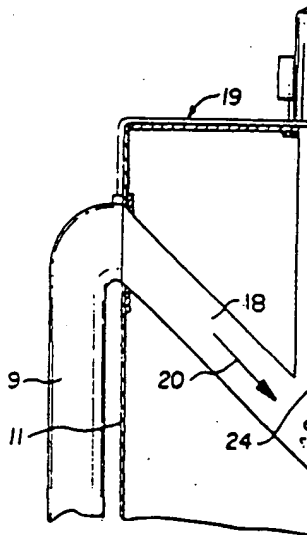


Exhibit 13.

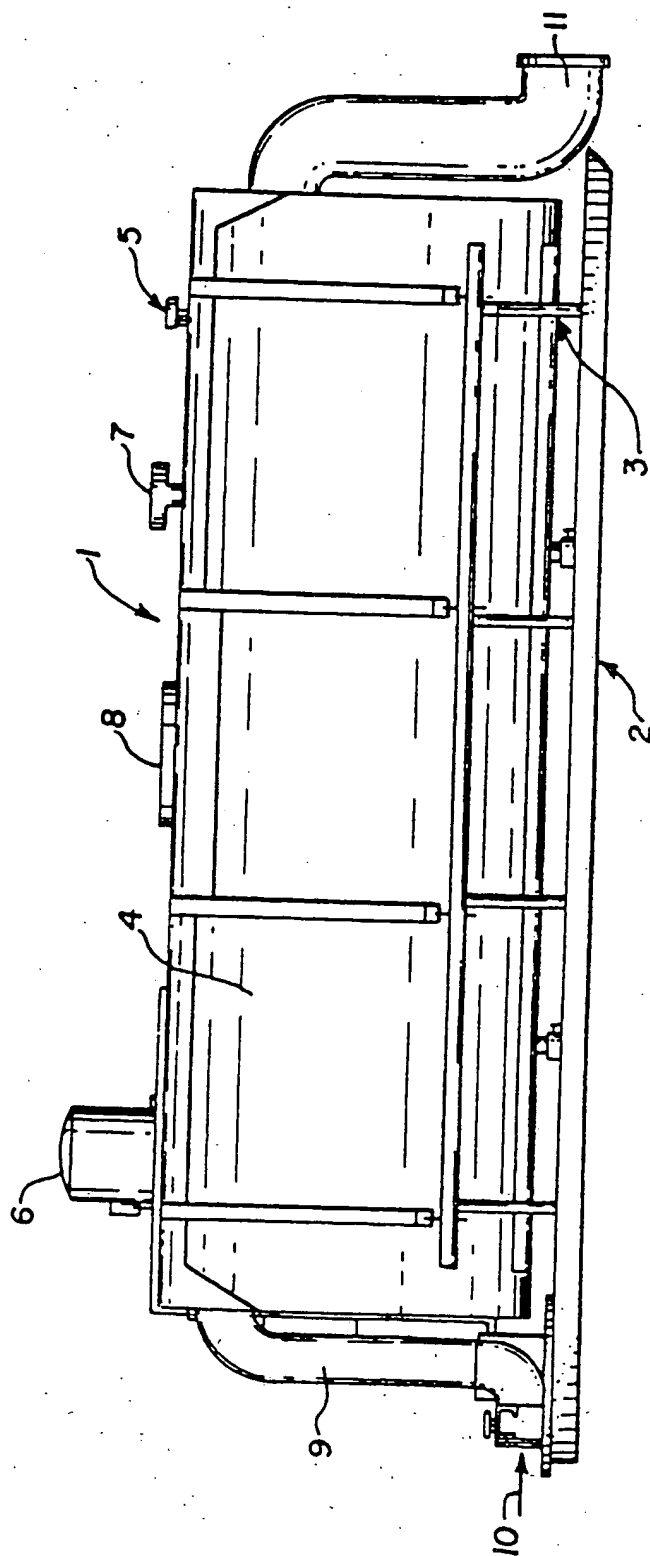


FIG. 1

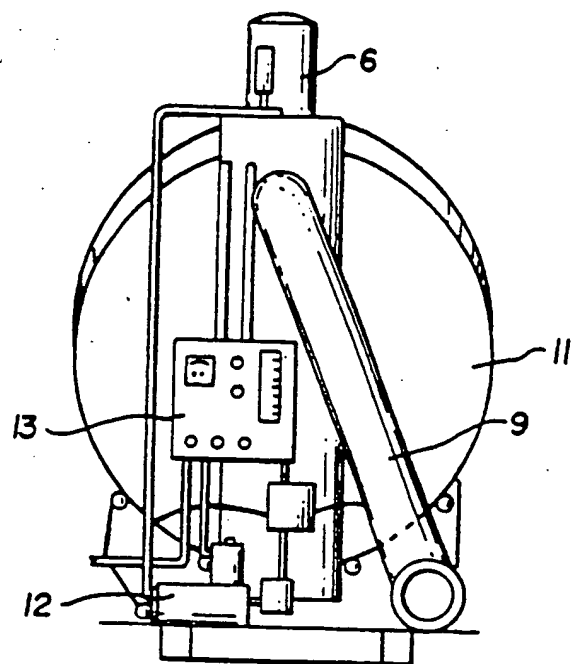


FIG. 2

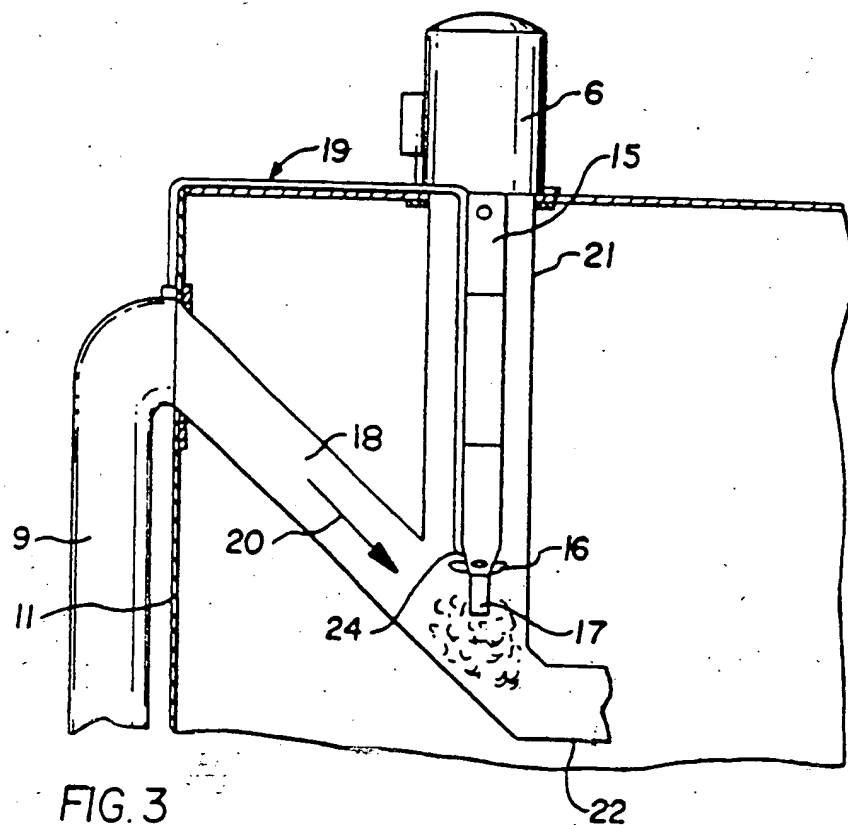


FIG. 3

METHOD AND APPARATUS FOR TREATMENT OF ACIDIC WATER

This is a continuation of application Ser. No. 820,955, filed Jan. 21, 1986 and now abandoned. **BACKGROUND OF THE INVENTION**

1. Field of the Invention

This invention relates to a method and apparatus for treatment of acidic water and more specifically it relates to water treatment of mine drainage.

2. Description of the Prior Art

Concern for the quality of natural water has grown in recent years. Acidic and metal-bearing discharges from mineral mining and processing, for example, has resulted in significant degradation of the quality of receiving streams and rivers. Lightly buffered waters in natural drainage systems have become acidic and have been depleted of dissolved oxygen, which causes the waters to be uninhabitable by most aquatic life forms.

Conventional mine acid treatment involves (a) neutralization, (b) aeration, (c) settling and disposal of sludge, and (d) effluent discharge. The conventional methods often involve long contact times for treatment chemistries to be effective. Furthermore, known methods involve large machinery which is not easily transportable. For example, U.S. Pat. No. 1,310,383 discloses a process for treatment of acid drainage water from mines. The disclosure involves a process whereby acid mine water is collected. The water is neutralized and the neutralized water is agitated and aerated, thus precipitating the resultant sludge.

U.S. Pat. No. 3,920,552 discloses a self-contained water treatment unit. This unit is retained on a large truck. The water is removed from a lake or stream and treated on the truck, then redeposited into the source.

U.S. Pat. No. 4,351,720 discloses a water treating apparatus. The apparatus is placed directly in a stream and has outwardly extending walls for receiving the water into the unit, which is treated therein.

Small operators with limited budgets are unable to provide the necessary complex water treatment facilities, such as discussed above. Therefore, the polluted water often goes untreated.

There remains a need for an improved apparatus and method for treating acid water, including mine acid water, which is portable and lower in cost than what has been known previously. There remains a need for such a device which is adapted to be used in any type of water source and which may be easily transportable. There remains a need for a method and apparatus that simultaneously provide aeration and neutralization of the water. There also remains a need for enhanced efficiency of water treatment units which minimize power consumption requirements and which thus lend themselves to remote and low-cost operation.

SUMMARY OF THE INVENTION

The present invention has produced a solution to the above-described need by providing a method and apparatus for treating acidic water. The apparatus is readily adaptable to provide the necessary equipment to treat acidic, metal-bearing water by means of an easily transportable package. The enhanced efficiency of the unit minimizes power consumption requirements and lends itself to remote and low-cost operation.

The invention provides an apparatus and method of water treatment for the purpose of precipitating metals

and neutralization of acid found in waters such as that which results from mine drainage. The apparatus of the invention is adapted to be a portable water treatment facility having the capability to introduce chemicals and gases into influent water. Treated water is discharged into a settling basin or thickener to allow settling of metal oxides and hydroxides. This produces a decanted water suitable for discharge.

More particularly, the apparatus, in a preferred form, consists of a skid, a cylindrical reaction vessel, a series of baffles within the reaction vessel, pH monitoring means, and piping to facilitate the contact of air, water and the necessary chemicals. Exterior to the tank are the aeration motor, metering pump, control panels, and other necessary parts. The method involves connecting the water treatment means to the water process stream. A source of power may be preferably incorporated into the unit. Also, a source of the necessary chemicals may also be incorporated into the unit.

An object of the present invention is to provide a readily transportable water treatment unit which effectively introduces chemicals and gases into influent water in order to oxidize metals and remove them through precipitation, to neutralize acid contained in the water, and further to introduce oxidants into the water.

It is a further object of the invention to maximize treatment of the water by introducing the neutralizing agent and the oxidant at the same point into the water system simultaneously.

It is yet a further object of the invention to provide an apparatus and associated method for treating water which utilizes a low power input and which provides water treatment at a low cost.

It is a further object of the invention to provide a neutralization means in generally close proximity to the aeration means, such that the introduction of the neutralization agent into the process stream is at about the same location as the introduction of the air, gases and/or oxidants.

It is yet a further object of the invention to provide a method for treating mine acid in a way which reduces the reaction time necessary for neutralization and oxidation of metals.

It is a further object of the present invention to provide an apparatus which is readily movable, requires no operator and makes optimum use of power and chemicals.

A further object is to provide a treatment apparatus which requires little maintenance.

These and other objects of the invention will be fully understood from the following description of the invention with reference to the illustrations appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of the apparatus of the present invention.

FIG. 2 is a side elevation of the apparatus of the present invention.

FIG. 3 is a sectional view of a part of the present invention showing the aerator motor and the point where oxidant and the neutralizing agent are simultaneously introduced into the system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides a method and apparatus for treating acid water such as mine acid water. The

apparatus preferably consists of a reaction vessel having a series of baffles therein, a pH monitoring probe and an aerator motor mounted on a skid and having the necessary piping connecting the aforementioned equipment. The apparatus is connected to a source of the raw water, such as a stream. The power source which may be, for example, a portable generator or line power, is connected to the apparatus to energize the system. A caustic substance is injected into the system which neutralizes the acid in the water. At generally the same point, an aerator introduces oxidant into the influent flow stream. The neutralization means and aeration means are in generally close proximity and oriented in generally the same axial position. The flow stream experiences substantially instantaneous elevation of pH and the oxidation rate required for treatment is thereby greatly accelerated. This eliminates the need for long contact times for treatment chemistries to occur.

Referring to FIG. 1, portable mine acidic treatment apparatus 1 is shown. The treatment unit 1 is preferably mounted on a skid 2 by suitable mounting means 3. The unit comprises cylindrical reaction vessel 4 having a plurality of baffles disposed therein (not shown). Reaction vessel 4 has pH monitoring probe 5 mounted thereon. This probe may be any suitable standard industrial quality pH probe. Aerator motor 6 is also mounted on reaction vessel 4. Reaction vessel 4 has air vent 7 and manway 8 on the top portion thereof.

Influent conduit 9 receives water from a source indicated by the arrow 10. Effluent conduit 11 discharges the treated water.

FIG. 2 shows metering pump 12, which is used to control the amount of fluid introduced into the system. Control panel 13 is used to monitor flow of fluids into the system. For example, a 1 GPM metering pump will treat 360 GMP of fluid containing 300 ppm iron using a 20% sodium hydroxide solution. The metering pump through a pH monitoring device maintains a proper pH level for the effluent.

The method of treating the water may be considered in connection with the apparatus shown schematically in FIG. 3. Influent water to be treated is received through influent pipe 9 and is transferred into reaction vessel 4 by way of conduit. The direction of flow is shown by arrow 20. Conduit 21 contains aerator shaft 15, which extends from aerator motor 6. Caustic feed line 19 extends along reaction vessel 4 in generally the same axial position and further in juxtaposition to aerator shaft 15, as shown in FIG. 3. Caustic feed line 19 connects caustic supply means (not shown) to the reaction vessel 4. The air flows through aerator shaft 15 and is agitated with aerator prop 16 at diffuser 17. At generally the same point, the neutralizing agent is received through caustic feed line 19 and enters the system just above aerator prop 16. At this point, the water to be treated represented by flow arrow 20 meets the oxidation and the neutralization agents, as shown at the point where diffuser 17 emits the oxidant.

The tank is constructed to allow for aeration and neutralization to take place at generally the same point in the process flow. In this way, the flow stream experiences instantaneous elevation of pH and the oxidation rate required for water treatment is greatly accelerated. After mixing of the oxidant, the caustic agent and the water to be treated, conduit 22 sends the mixture to an area of the tank that may contain internal baffles (not shown).

Internal baffles allow for mixing, turbulence increasing and extended contact time. The baffles insure that the treatment reactions are complete prior to discharge from the reaction vessel. The baffles are preferably elongated planar sheets spaced equidistantly throughout the tank. They may be the full height of the tank or only a portion of the height of the tank. The size of the openings and the location is dependent upon the fluid being processed. For example, in a 1,000 gallon tank two baffles may be placed an equal distance from each other and from the walls of the tank. The baffles may be stationary fiberglass perforated plates spaced evenly in the tank. The number of baffles, the height of the baffles inside the tank and the size of the openings are dependent upon the type of fluid flow that is contemplated for the system.

In operation, the device receives water to be treated 10 through influent pipe 9. The water is received generally in reaction vessel 4. The water is thus received into conduit 18 and is sent to the point of mix. Aerator motor 6 creates a flow of air (oxygen) through aerator shaft 15. Simultaneously, a neutralizing agent, such as sodium hydroxide, potassium hydroxide, and mixtures thereof, is sent through caustic feed line 19. The air is discharged at diffuser 17 and the neutralizing agent is discharged at the end 24 of caustic feed line 19. Aerator prop 16 agitates the surrounding fluid and the neutralizing agent, and the gas and the water to be treated are thereby mixed. As stated hereinbefore, the flow stream thus experiences sudden elevation of pH which greatly accelerates the oxidation rate required for treatment. The resulting fluid is sent to a detention structure for clarification of the treated effluents. The treated water can be discharged to a settling structure for solids removal. At this point, the settlement of sludge occurs.

The simultaneous introduction of the air, water and the chemical in a regulated manner accelerates the reaction time. Because of this instantaneous reaction time, large bulk mixing and reaction chambers are not needed. Through the use of precision metering and control equipment, the process disclosed is self-regulating, compact, easily transportable, and can operate on a number of different power sources such as a portable generator or line power.

The unit can be readily transported, requires no operator, makes optimum use of power and chemicals, and requires little maintenance. In addition, the possibility exists that ozone, alone or with different reagents such as hydrogen peroxide, can be combined in the same manner to expand the environment in which this invention may be used. That is, other environments and other types of chemicals for treating various types of pollution are contemplated as within the scope of the claimed invention.

Whereas particular embodiments of the invention have been described above, for purposes of illustration, it would be evident to those skilled in the art that numerous variations of the details may be made without departing from the invention as defined in the appended claims.

I claim:

1. A water treatment apparatus comprising,
 - a reaction vessel,
 - a source of acidic or metal-bearing water,
 - influent pipe means operatively connected to said reaction vessel for delivering said water to be treated from said water source to said reaction vessel,

aerator means having a shaft extending therefrom into said reaction vessel said shaft having a discharge end for discharging oxidant, said aerator means having agitation means, said influent pipe means disposed generally adjacent to the discharge end of said aerator shaft, a neutralizing agent feed line means leading from neutralizing supply means into said reaction vessel for delivering neutralizing agent, said neutralization feed line means operatively associated with said aerator shaft such that a discharge end of said neutralizing agent feed line is positioned generally adjacent to said agitation means, pump means operatively associated with said reaction vessel, power source means operatively associated with said reaction vessel for energizing said apparatus, effluent discharge pipe means operatively connected to said reaction vessel for discharging the water, and automated metering and control means for delivering said neutralizing agent into said reaction vessel through said neutralizing agent feed line means and oxidant from said aerator means at substantially the same time, whereby said oxidant impinging upon the water entering said reaction vessel will aerate said water and establish mixing therein so as to enhance efficiency of distribution of said neutralizing agent in said water to reduce reaction time and enhance efficiency of said reaction.

2. The apparatus of claim 1, wherein said influent pipe is disposed closely adjacent to the discharge end of said aeration shaft, whereby the relative general proximity of said water source means, said neutralizing agent, feed line discharge end, and said agitation means will enhance the efficiency of the reaction.

3. A method of treating acidic water comprising, providing a treatment unit comprising aerator means, said aerator means having a shaft extending there-

from into said treatment unit and said aerator means having agitation means, influent pipe means disposed generally adjacent to the discharge end of said aerator shaft and neutralizing agent feed line means disposed generally adjacent to the exit of said aerator means, providing means for introducing a source of acidic or metal-bearing water into a treatment unit, introducing said water to be treated into said treatment unit, introducing a neutralizing agent into said treatment unit, introducing oxidant at generally the same point at which said neutralizing agent is introduced into the water to be treated, agitating said water, oxidant, and neutralizing agent, providing a means for receiving precipitants from said mixture, and discharging treated water from said treatment unit.

4. The method of claim 3, wherein said primary oxidant source is air.

5. The method of claim 3, wherein the neutralizing agent and the oxidant are substantially simultaneously introduced into said water.

6. The method of claim 3 wherein said method is employed in treating mine acid water.

7. The method of claim 3 wherein prior to treatment, said water is removed from a stream and introduced into said treatment unit; and after treatment said treated water is discharged into a settling structure for solids removal.

8. The method of claim 3 wherein prior to treatment, said water is removed from a stream and introduced into said treatment unit; and after treatment said treated water is discharged into a settling structure then into said stream.

9. The method of claim 3 wherein the pH is substantially instantaneously elevated.

.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. 4,749,497

DATED June 7, 1988

INVENTOR(S) R.S. KANZLEITER, T.G. SIMONETTI, K.E. BALL, S.M.
STEVENSON

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, lines 6-7, "cl" should be deleted and "BACKGROUND OF THE INVENTION" should be centered on line 7.

Column 1, line 64, "enhance" should be --enhanced--.

Column 3, line 3, "erator" should be --aerator--.

Column 4, line 38, "Beacuse" should be --Because--.

Claim 2, column 5, line 36, "reation" should be
--reaction--.

Signed and Sealed this

Twenty-seventh Day of December, 1988

Attest:

DONALD J. QUIGG

Attesting Officer

Commissioner of Patents and Trademarks

EXHIBIT 14

IN THE UNITED STATES COURT OF FEDERAL CLAIMS

CHEMICAL SEPARATION TECHNOLOGY, INC.
and SANFORD M. STEVENSON,

Plaintiffs,

v.

THE UNITED STATES,

Defendant.

No. 97-21 C

Judge Francis M. Allegra

AFFIDAVIT OF SANFORD M. STEVENSON
IN SUPPORT OF RESPONSE IN OPPOSITION TO
DEFENDANT'S SUPPLEMENTAL ARGUMENT

And Now, this 10th day of November, 1999, I, Sanford M. Stevenson, being 57 years of age, of sound mind, and competent to testify, state under oath and penalty of perjury pursuant to 28 U.S.C. § 1746 the following upon my personal knowledge:

I, I am the president
involved with the installation
Consolidated Mining Company
Construction of an operational
startup of the installation of the
site on July 24, 1992. I return
Invoice attached as Exhibit 2) D
finalize and make predictable the
5,370,800, granted on December 6, 1994, entitled "Method for Removing Metal Compounds
from Waste Water" (hereinafter '800 Patent). ('800 Patent attached as Exhibit 3)

was personally
Summitville
Resources, Ltd.
I began initial
92 and left the
992. (see
presentation to
Patent No.

Exhibit 14

EXHIBIT

15

DEPOSITION
EXHIBIT

D-15

4/26/00

2. I was personally involved with the lease of a prototype metals removal system to Pennsylvania Electric in January 1991.

3. Based upon my 14 years of experience in the water treat industry, two species of metals exist which industries are required and/or desire to remove from waste water streams. The first species is ferrous, the second is non-ferrous. Due to the magnetic properties of ferrous metals, the metals removal process I created for removal of ferrous metals from a waste stream would not, and did not, provide a predictable process for metals removal from a waste stream of non-ferrous metals, such as copper.

4. The Pennsylvania Electric experimental metals removal system was designed to primarily remove iron. The dominant presence of iron in the Pennsylvania Electric waste stream enabled the prototype to also remove small amounts of non-ferrous metals such as manganese and aluminum. The Pennsylvania Electric prototype was not designed to primarily remove non-ferrous metals.

5. Because of the ability of the reactor claimed in my '497 Patent to control the Ph of the waste stream, coupled with the dominate presence of iron in the Pennsylvania Electric waste stream, a positive charge from the iron particles being precipitated out of the waste stream was powerful enough to co-precipitate small amounts of non-ferrous metals such as manganese and aluminum which were present in the waste stream. (See Defendants Exhibit 22, bare stamp page P005629) Without the dominant presence of the iron in that waste stream, however, precipitation of non-ferrous metals from a waste stream would not, and did not work under the experimental process developed at Penn Elec in Indiana Pennsylvania.

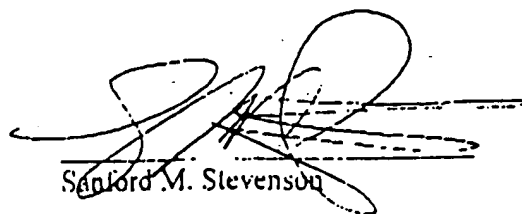
6. The PITS System, constructed for Summitville Mining Company, (Gallactic, Ltd.), was designed to remove primarily non-ferrous metals, specifically copper, because the

dominant metal in the Summitville Mine waste stream was cooper. Insignificant amounts of iron also existed in the waste stream at Summitville.

7. The types, dosages, dilutions, and type specific injection, placement of polymers, and required settlement parameters used on Pennsylvania Electric's waste stream were different than those used at Summitville because the dominate type of metal being removed was different, *i.e.* at Summitville copper, at Pennsylvania Electric, iron.

8. I personally experimented with the types, dosages, dilutions, and type specific injection and placement of polymers at Summitville because the types, dosages, dilutions, and type specific injection and placement of polymers I used at Penn Elect did not work for cooper, only for a waste stream dominated by the presence of iron.

9. On August 5, 1992, as is stated in my prior affidavit, I complete and perfected the process I ultimately claimed in the '800 Series Patent which allowed me to remove all of the metals claimed in claim 1 of the '800 Series Patent, including the non-ferrous metal cooper.



Sanford M. Stevenson

Sworn and Subscribed to me

this 10th day of November, 1999

Notary Public

EXHIBIT 15

ROTH - DIRECT

583

Q That is Exhibit 133.

MR. KENNY: It should be right up in front of him,
Mr. Tarasi.

MR. TARASI: Where is it?

MR. KENNY: It should be right up in front of him.

THE COURT: Have you got it?

MR. TARASI: I'm sorry, Judge. May I approach the
Witness?

THE COURT: No, that's okay.

THE WITNESS: Yes, sir.

BY MR. TARASI:

Q Now, you heard Mr. Dupon testify that he
considered the English patient [sic] to --

(Laughter.)

MR. TARASI: That's been going through my head,
Judge, forever.

THE COURT: It is a movie, not a patent.

BY MR. TARASI:

Q -- the Inglis patent was an anticipation or an
obvious type of situation where you could adapt or use to
get the 497 patent. Now, will you tell us what the Inglis
patent -- how the Inglis patent is different from the 497
patent?

A It is significantly different, sir. As a
practical matter, it must be operated -- it can be operated

ROTH - DIRECT

584

somewhat continuously. But it must be operated in a batch mode. There is a batch element to it regardless of how you operate it.

Battery waste -- I have been through some -- and worked for -- on some battery plant waste. They have very low water flows. They reduce the amount of water and the lead for environmental purposes.

Q Now, is this patent, in effect, a battery waste treatment patent?

A Yes, sir. It is.

Q Okay. And you heard Mr. Dupon was questioned, if you wanted to make it a continuous type of operation, what would that take to do it? What size tank? He couldn't seem to calculate it. Can you tell us, what would it be?

A That is in reference to if you were trying to treat a waste of 500 gallons per minute which is much, much higher than one would encounter in an acid battery plant. But assuming you had that quantity of waste, you would need approximately 760,000 gallons of tank to treat an equivalent amount to 500,000 -- to 500 gallons per minute as compared to the 0.33 gallons per minute described in the patent.

Q As a practical matter, would you have to break down the 730,000 gallon tank into separate other tanks?

A Yes, sir. You would have other tanks.

Q And would that cover -- what size of area

ROTH - DIRECT

585

approximately?

A Large.

Q Okay. And it certainly wouldn't be portable?

A It would not be portable, nor would it be practical.

Q Also, I noticed the Inglis patent has two stages, doesn't it, sir?

A Yes, sir. It does.

Q And if you have that in front of you, I noticed in the second stage in column 7, at line 60 to 65 -- do you have that in front of you, Doctor?

A Yes, sir.

Q And it says at line 63, "After approximately one minute of mixing, the system is shut off and the contents of final treatment tank 50 are allowed to settle from two to 24 hours, and most preferable about 20 hours." Is that what it says?

A Yes, sir.

Q And that is in the second stage of this two-stage process for the Inglis patent.

A Yes, sir. That is correct.

Q Now, in the 497 patent, there has been testimony by Mr. Dupon he did not think it would work. Have you seen the 497?

A The patent, sir?

EXHIBIT 16

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Sanford M. Stevenson

Serial No: 09/652,272

Examiner: P. Hruskoci

Filed: September 17, 2000

Art Unit: 1724

For: METHOD FOR REMOVING METAL WASTE COMPOUNDS
FROM WASTE WATER

Assistant Commissioner for Patents
Washington, D.C. 20231

**DECLARATION OF SANFORD M. STEVENSON
UNDER 37 CFR § 1.132**

I, Sanford M. Stevenson, hereby declare as follows:

Introduction

1. I am the applicant in the above captioned application, and I am familiar with the prosecution thereof.
2. The purpose of this Declaration is to clarify certain facts in other exhibits relevant to this application.

Exhibit A: Explanation of Co-precipitation of Other Metals with Iron

3. I do not believe that existence of minor amounts of manganese and aluminum recovered with iron in a predominantly iron contaminated waste stream at the Keystone Plant would be predictive that copper could be recovered from a predominantly copper contaminated waste stream for the following reasons.

4. I believe that one skilled in the art would understand that other metals would usually be present with iron in a predominantly iron contaminated waste stream. The fact that one or more of these other metals might be precipitated with iron might, in my experience, be expected, but, these same metals might not precipitate when iron is not present.

5. My understanding of the reason for co-precipitation with iron is due to a phenomenon known as "occlusion" in which the iron forms a matrix and other metals are incorporated in the iron matrix. This occlusion phenomenon is further described, for example, in the attached pages 7 - 9 of a publication entitled Unipure; Heavy Metal Removal Technology (dated June 26, 1998).

6. In view of 5 above, I do not believe it would have been reasonably predictable that a predominant metal such as copper would precipitate under conditions of a non-predominant iron being present just because non-predominant aluminum and manganese co-precipitated under those conditions with iron.

Exhibit A: Opinion regarding Principal Subject of This Report

7. In further regard to Exhibit A, at the time that the report was prepared, I had only begun experimenting with flocculation. The matters I discussed with the person who prepared the report principally related to the method and apparatus described in the '497 Patent, which related to neutralization and metal precipitation. Consequently, it is my opinion that the conclusions of the report were directed principally to the method described in the '497 Patent rather than to the overall process which included flocculation. This is not to say that the issue of flocculation was ignored, but my recollection is that the main concern was the

success of the neutralization and metal precipitation. I believe that my opinion is supported by the Introduction section of the report at pages 1 - 3 of the report.

Exhibits 6 and 7: Further Explanation of Experimental Work at the Keystone Plant

8. The information concerning experimental use at the Keystone Plant in Exhibits 6 and 7 is supplemented as follows.

9. I believe that this experimental work was reasonably necessary to establish the invention on a predominantly iron waste stream since my experience is that these type of processes tend to be unpredictable, particularly with regard to flocculation. In my opinion, this work was performed systematically. I personally did this work or it was done under my supervision. Written records were kept. I received payment for this work, but this payment essentially defrayed the cost of having my company perform this work. I believe that I could have done other work which would have paid me as much or more, but I chose to do this experimental work to enable me to develop and improve the practice of my invention. My principal motivation was to develop and improve my invention for use in future prospective projects rather than to make a profit on this experimental work. I believed that my invention was an important advance in the art and I wanted to complete all experimental work on the project in order to develop and improve my invention toward an embodiment which would be widely used in the industry. As I recall, the hourly rates charged for personnel working on this project were often generally less than those being charged on other projects at the time in the geographical area. There were also a number of other wastewater treatment facilities which I did not operate at the Keystone Plant

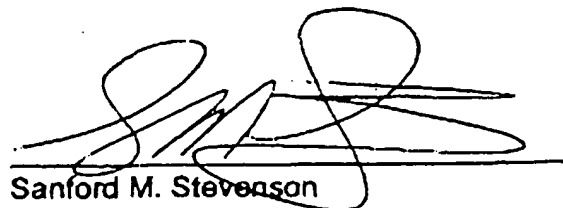
whose primary function was to treat the plant's wastewater, rather than experimentation.

**Exhibit 14. Explanation of Lack of Knowledge of Process Conditions to be used
during Discussions with Gallactic Resources**

10. To further explain this exhibit, in my discussions with Gallactic Resources in April - May, 1992, I did not know if my process would work on a predominantly copper waste stream, but if the process did work, I did not know at the time what process conditions I would use. In particular, if I could get my process to work on their predominantly copper waste stream, I did not know what rate of aeration I would need or if I would be within the range of the process conditions now recited in claim 7 of the present application. On my reactor I was able to vary the rate of aeration by varying horsepower or the water flow rate.

11. My uncertainty as to what process conditions I would use, or if I could get my process to work at all, resulted from the fact that I had never used my process on a predominantly copper waste stream. I believed that I might have to use a process which would have been quite different from the process conditions which I had previously used on a predominantly iron waste stream. Furthermore, the predominantly copper waste stream on which I would be working was located at an elevation of more than 11,000 feet above sea level, and I believed that the thin air might affect the process and might also require me to make substantial changes to my process conditions. If I could get my process to work at all:

12. All statements made herein are true or if based on information are believed to be true, and I have been warned that willful false statements are punishable by fine or imprisonment (15 USC 1001) and may result in the invalidity of this application or any patent issuing thereon.



Sanford M. Stevenson

2106 Washington Road, Suite 200
Canonsburg, Pennsylvania 15317

November 09, 2001

Unipure Heavy Metal Removal Technology

Page 8 of 11

of the Unipure Reaction

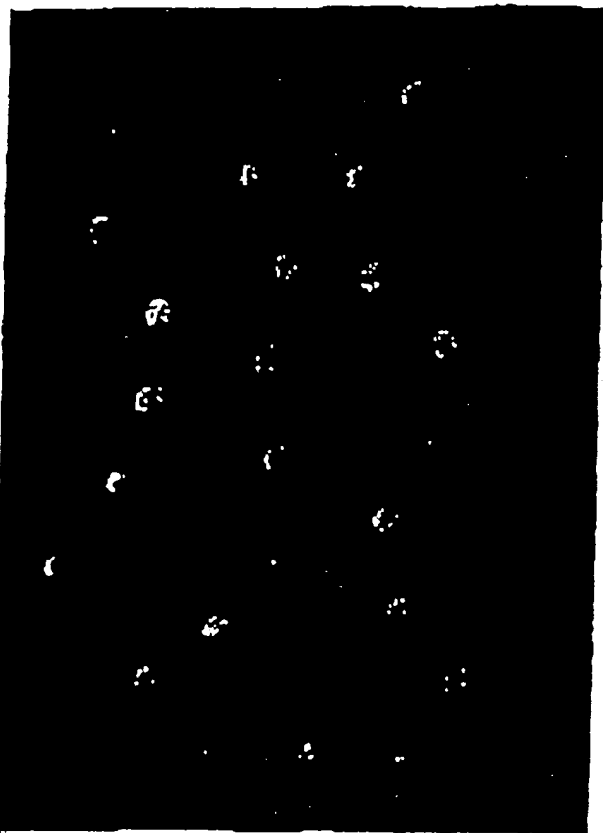


Figure 6

In the reaction zone, base is added to control the pH to 7.8 and air is sprayed to rapidly oxidize the ferrous iron to ferric (Fe^{+3}) iron. Through this rapid oxidation the solubility of the iron falls from the Fe^{+2} curve to the Fe^{+3} curve shown on Figure 5. As the iron drops out of solution, it incorporates the heavy metals in a dense iron matrix as it forms. The metals are "occluded" in the iron solids due to their close association with the iron prior to precipitation. The occluded metals are effectively enveloped in iron. This presents itself to the surrounding solution as an Fe^{+3} particle and follows the Fe^{+3} solubility curve. The occluded metals are insulated from the solution by the iron, and so are not allowed to resolubilize as solubility increases as Figure 5 would indicate. This phenomenon makes it possible to remove heavy metals from water to concentrations well below their natural background levels.

Other metals that are not removed by occlusion are removed by a second reaction stage which operates simultaneously with the first. Two chemical processes make this second removal possible:

- As mentioned earlier, ferric iron solids tend to adsorb heavy metals to their surface.
- Ferric iron acts as a catalyst for the oxidation of ferrous to ferric (i.e. the reaction is autocatalytic).

Ferric iron solids are present in the Reactor as a result of the oxidation of ferrous iron, and occasionally as a result of recycle from the clarifier. The solids, due to the very high shear environment of the Unipure Reactor, are highly fractured resulting in a very high surface area and many active adsorption sites. The heavy metals in solution adsorb to the surface of these solids in the Reactor. As ferrous iron enters the Reactor with the contaminated stream, the iron preferentially precipitates, due to the autocatalytic effect, on the solids which have already formed. This layering of iron precipitate on top of adsorbed heavy metals produces results similar to those achieved by the first mechanism; the heavy metals are effectively removed from solution and are isolated from the solution so that they cannot freely follow their solubility curves as the pH varies. This reaction mechanism also results in extremely dense solids since the precipitation is occurring directly on the surface of other solids. A slower precipitation of iron solids which are dispersed freely in solution produces a much less dense, and often colloidal mass of solids.

DISCUSSION

The unique chemical mechanisms of UNIPURE Process Technology, combined with the many desirable characteristics of iron, result in a treatment process which is able to remove heavy metals to very low limits, and produces numerous other beneficial features:

- Hexavalent chromium is removed by UNIPURE Process Technology without the need for reduction pretreatment. As the ferrous iron is added to the contaminated water, the $\text{Cr}+6$ acts as the oxidant in place of the air. The hexavalent chromium is reduced to trivalent chromium as the ferrous iron is oxidized to the ferric state, and both are then effectively removed from solution as the Unipure Solids form.
- Any base may be used with UNIPURE Process Technology. The removal of heavy metals is dependent only on the chemistry of iron, and so the base may be chosen to minimize cost, minimize solids

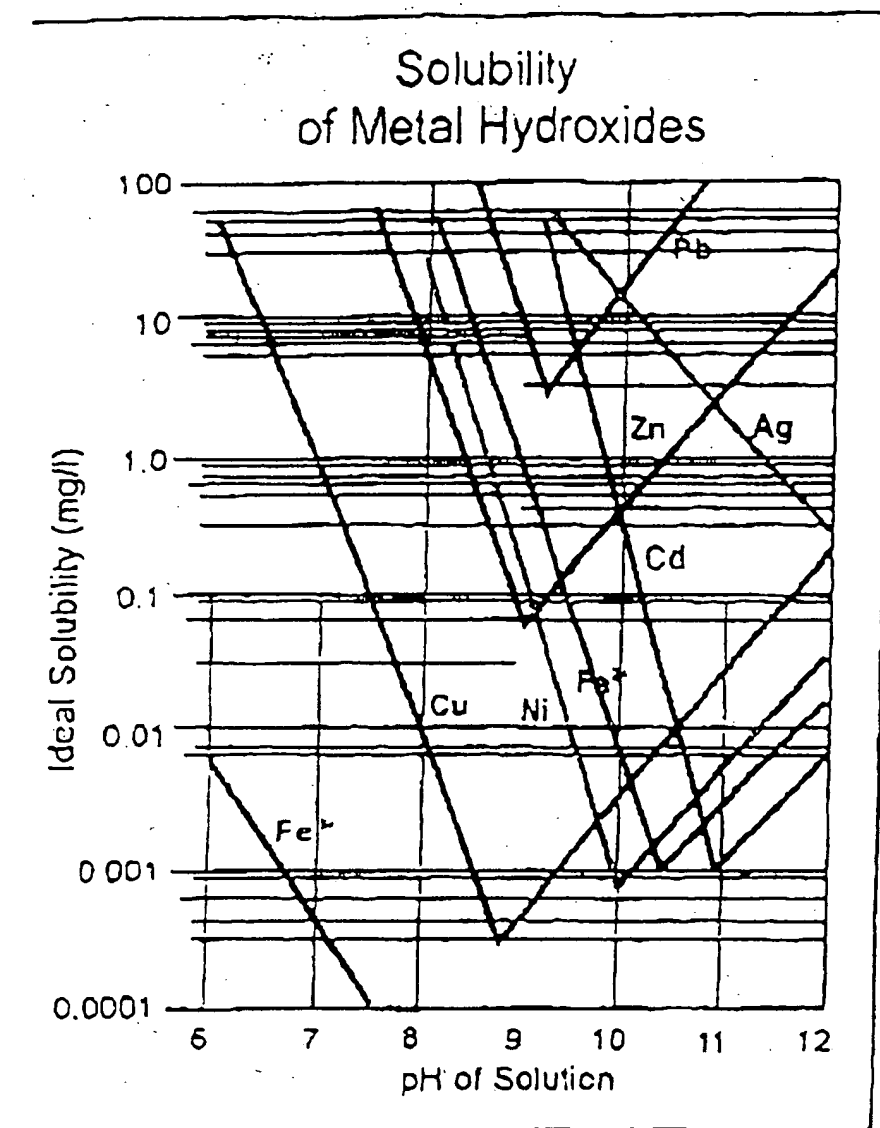


Figure 5

UNIPURE Process Technology

When ferrous iron (Fe^{+2}) is added to water, the iron tends to form a soluble chain-like structure in solution due to the weak ionic attractions between molecules. Figure 6 shows a simplified example of such a chain. In a contaminated water stream with heavy metals present, the heavy metals may be substituted into the chain in place of some of the iron atoms. This close association between the heavy metals and the iron, which occurs soon after the two are commingled, provides the mechanism by which the iron can be targeted to most efficiently remove the heavy metals. After the soluble association is formed, the water is introduced to the reaction zone

EXHIBIT B

CHEMICAL SEPARATION TECHNOLOGY, INC.

April 16, 1992

Summitville Consolidated Mining Co., Inc.
P. O. Box 2G
Del Norte, Colorado USA 81132

Attention Mr. Bill Williams

RE: Preliminary Proposal 4/14/92
Reynolds ADIT

Dear Bill,

Per our telephone conversation 4/14/92 the effluent discharge quality at the above subject site should be as follows.

pH	7.5
Fe	< 1 Mg/l
Cu	< .1 Mg/l
Mn	< 1 Mg/l
Zn	< 1 Mg/l

All discharge limits have been determined from the raw water quality data that you forwarded to me earlier. Historically we have experienced metals discharge ranges in the .002 Mg/l ranges and those limits could be achievable at the ADIT site.

Please call me if I can be of further assistance.

Very truly yours,

Chemical Separation Technology, Inc.


S. M. Stevenson
President

SMS/ds

201410

D004006

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurry, Pennsylvania 15317 • (412) 942-0674 • FAX (412) 942-0436

EXHIBIT E

CHEMICAL SEPARATION TECHNOLOGY, INC.



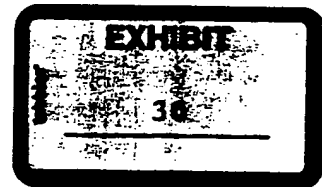
COPY

May 15, 1992

Summitville Consolidated Mining Co., Inc.
P.O.Box 2G
Del Norte, Colorado, USA 811362

Attention Mr. Bill Williams

Subject: Galatic/Summitville
C.S.T. Mobile Caustic Treatment and
Dewatering Systems



Dear Bill,

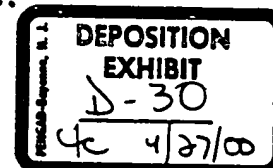
I hope the following information along with the drawings sent to you by Federal Express, 5/14/92, is the information you require.

CST units are adaptable to alternate energy, oxidation and chemical inputs to treat and dewater most waste water discharges of acidic or alkaline nature.

CST neutralization units optimize chemical use and eliminates continued operator labor input. At present we have units in the field capable of treating raw water from 150 GPM to 2500 GPM.

CST units servo automatically for changes in flow, temperature, acidity, alkalinity, heavy metals and neutralizer strength. All controls and sensors are interfaced with a programmable controller. An aerator/mixer oxidizes the metals and mixes the continuous process. All components are combined in a compact patented method to facilitate an instantaneous reaction and optimize chemical consumption.

CST units are designed and built to an owner's particular site and/or water quality requirements.



D004002
201406

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurray, Pennsylvania 15317 • (412) 942-0679 • FAX (412) 942-0436

CHEMICAL SEPARATION TECHNOLOGY, INC.

Summitville Consolidated Mining Co., Inc.

Page 2

May 15, 1992

The design criteria for your Reynolds ADIT site is as follows:

Water Quality Worst Case

Flow	100 GPM
pH	2.98
Acidity	2200 Mg/l
Iron Fe++	460 Mg/l
Copper	190 Mg/l
Managanese	26 Mg/l
Zinc	34 Mg/l

Utilization of 50% NaOH solution at 100 GPM raw water and 2200 Mg/l acidity, will be approximately 14 gallons per hour respectively in the worst case scenario.

Operational Sequence:

Raw water shall be pumped from a holding pond to the CST reactor at 100 GPM.

Sodium Hydroxide and oxygen will then be added and mixed with the raw water to boost the pH instantly to 8.5 (other pH values can be programmed).

Neutralized/oxidized effluent is then discharged from the reactor to the clarifier/settling tank.

Supernate from the clarifier/settling tank is then discharged to the polishing tank.

Clean supernate is then discharged from the polishing tank to the stream.

When sludge buildup in the clarifier/settling tank is to within 12" from the supernate discharge port the treatment system will be shut down and dewatering of the sludge will begin.

Sludge will be pumped at approximately 2% solids to the rotary thickener flocculation tank where polymers will be

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurray, Pennsylvania 15317 • (412) 942-0679 • FAX (412) 942-0436

201407
0004003

CHEMICAL SEPARATION TECHNOLOGY, INC.

Summitville Consolidated Mining Co., Inc.

Page 3

May 15, 1992

added. The sludge continues thru the rotary thickener to the discharge hopper where it will be pumped or conveyed to a dump truck for disposal.

The system components are as follows:

- 1) One (1) truck mounted treatment system
- 2) One (1) 9,000 gallon skid mounted storage tank
- 3) Emergency shower
- 4) Two (2) 21,000 gallon mobile clarifiers
- 5) One (1) 100 GPM rotary thickener complete
- 6) Polymer dosing units
- 7) One (1) loading conveyer

Summitville shall supply and maintain the following:

- 1) An accessible haul road to the building
- 2) One (1) 100 AMP 480 VAC 3 phase 60 HZ power source to within 10 feet of the MCTS
- 3) Telephone line
- 4) Potable water line
- 5) Raw water collection pond
- 6) Raw water pumping
- 7) Piping or miscellaneous hoses and fittings from the raw water collection pond
- 8) Chemicals (caustic and emulsion polymers)
- 9) Plant service personnel - CST to train
- 10) Sludge hauling and disposal

D004004

201406

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurray, Pennsylvania 15317 • (412) 942-0679 • FAX (412) 942-0436

CHEMICAL SEPARATION TECHNOLOGY, INC.

Summitville Consolidated Mining Co., Inc.

Page 4

May 15, 1992

Please call me if you need any additional information.

Very truly yours,

Chemical Separation Technology, Inc.



S.M. Stevenson,
President

SMS/tm

201409

D004005

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurray, Pennsylvania 15317 • (412) 942-0679 • FAX (412) 942-0436

EXHIBIT F

CHEMICAL SEPARATION TECHNOLOGY, INC.

May 15, 1992

Summitville Consolidated Mining Co., Inc.
P.O. Box 2G
Del Norte, Colorado, USA 81132

Attention Mr. Bill Williams

Subject: Metals Removal Reynolds ADIT

Dear Bill,

Per our telephone conversation yesterday, you inquired about additional metal recovery at the Reynolds ADIT Site as follows:

Mercury	<.0001 Mg/L
Lead	.37 Mg/L
Cadmium	.25 Mg/L

As I explained, the above metals will experience some co-precipitation with Fe and Cu. However, the extent of the co-precipitation will have to be determined once the system is on site and all chemical additions and pH adjustments are operating properly. The first few sets of internal plant analyses should give us the necessary baseline to determine the amount of co-precipitation of these metals.

If you need any additional information for your report, please contact me at your convenience.

Very Truly Yours,

Chemical Separation Technology, Inc.


S.M. Stevenson

SMS/tm

201411

D004007

INNOVATIVE ENVIRONMENTAL TECHNOLOGIES

Post Office Box 931 • McMurray, Pennsylvania 15317 • (412) 942-0679 • FAX (412) 942-0436

CST

CHEMICAL SEPARATION TECHNOLOGY, INC.

Client List

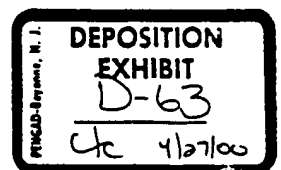
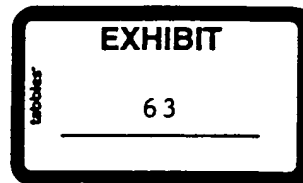
Waste Water Treatment Neutralization Facility Turnkey Project and Services	Aloe Coal Midway, PA 1986
Waste Water Treatment Neutralization Facility Turnkey Project and Services	Mincorp Somerset, PA 1986
Waste Water Treatment Neutralization Facility Turnkey Project and Services	Penelec-Keystone Station Shelocta, PA 1987
Waste Water Treatment Neutralization Facility Feasibility Study	British Petroleum, Inc. Cleveland, OH 1988
Waste Water Treatment Neutralization Facility Feasibility Study	Consolidation Coal Co. Pittsburgh, PA 1988
Waste Water Treatment Neutralization Facility Feasibility Study	Old Ben Coal Cleveland, OH 1988
Waste Water Treatment Neutralization Facility Feasibility Study	Homestake Mining California 1988
Waste Water Treatment Neutralization Facility Turnkey Project and Services	Old Ben Coal J. R. Plant, Benton, IL 1989
Sludge Dewatering Facility Turnkey Project and Services	Penelec-Keystone Station Shelocta, PA 1989
Waste Water Treatment Neutralization Facility Turnkey Project and Services	LTV Steel Company Meadowlands, PA 1991

EXHIBIT G

CHEMICAL SEPARATION TECHNOLOGY, INC.

Business Plan and Financial Forecast

July, 1991



CST 0121

TABLE OF CONTENTS

	<u>Page</u>
Executive Summary	1
Confidentially Agreement	5
Introduction	10
o What is CST	
o Mission Statement and Goals	
o Corporate Structure	
o Personnel Summaries	
o Description of Process	
o CST Service Business Concept	
Technical Description	15
o Detail Description of Process	
o Patent Discussion	
o Competitive Processes	
o Compliance with EPA Discharge Standards	
o Significant Provisions of the Clean Water Act	
Market Analysis	20
o Utility Power Plants	
o Coal Mines	
o Metals Mines	
o Projects in Service	
o Proposals Outstanding	
o Development of Alternative Applications	

Current Financial Status

- o 1990 Financial Statements
- o 1991 Financial Statements (Period Ending June 30)

Financial Forecasts

- o Forecasted Income Statements
- o Forecasted Balance Sheets
- o Forecasted Cash Flows
- o Assumptions

Appendices

- o Patent
- o Pictures
- o Proposals and Drawings
- o Market Opportunities
- o Standard Service Contract
- o Summary of Clean Water Act Revisions
- o Resumes

EXECUTIVE SUMMARY

Chemical Separation Technology, Incorporated (CST) is a water treatment service company with offices located in Vancouver, Washington, and Pittsburgh, Pennsylvania. CST provides services focused towards utility companies and the metals and coal mining industries. The Company installs its high-tech acid neutralization treatment units on client's sites to process acidic discharge contaminated with metals in solution, producing an effluent which meets EPA discharge standards. The CST mission statement is to resolve environmental discharge problems for clients through the delivery of price competitive treatment services which will allow them to achieve regulatory compliance and environmental recognition.

CST's core business focus is to own and operate as a turnkey provider of water treatment services, addressing each client's particular environmental discharge problems. We do not intend to market our patented equipment for resale as a manufacturer. CST operations are supported by principals with broad experience in organization, planning, management, operations, engineering, technological and financial matters and also possess strong expertise and contact networks in the utility and mining industries.

CST is a patented process (United States Patent Number 4,749,497) which provides a unique method for treatment of acidic and metals-contaminated leachates. The patented CST equipment is comprised of a cylindrical reaction vessel with internal baffles, computer-controlled pH monitoring and recording equipment, an aeration motor, piping and chemical storage tanks. The equipment is easily scaled to handle volume flow rates ranging from as small as ten gallons per minute to major flows of 10,000 gallons per minute. For flow rates from ten to 500 gallons per minute the CST reactor and ancillary equipment is portable, being either skid-mounted or installed in van-type trailers. The capital cost for a CST unit is significantly less than alternative lime base treatment systems.

The CST process combines sodium hydroxide and oxygen with the leachate in a patented reactor to neutralize acid and precipitate metals. Air is continuously drawn into the reactor in the form of very fine bubbles and mixed simultaneously with concentrated sodium hydroxide to create localized pockets of high oxygen concentration and alkalinity. Use of state-of-the-art computerized process control instrumentation holds the pH at a constant level allowing point precipitation of metals in solution. The net effect of this design is an acceleration in the oxidation and precipitation rates which are considerably higher than those achieved by conventional mechanical agitated, lime-based processes. Sludge thickening, dewatering, clarification and filtration steps, reduce solid wastes to minimal volume in order to recover the precipitated metals for efficient disposal or reuse.

Liquid-solid separation processes using clarification and belt filtration recover approximately 15,000 pounds of solids daily. The facility routinely accepts and treats higher level excursions of acidity and metals in solution up to 6,000 mg/l and 7,000 mg/l respectfully. At the LTV site, their current Pennsylvania DEQ permit allows the leachate to be neutralized and discharged into a bore hole to an abandoned mine shaft where the metals precipitate out of solution. More recent regulatory permitting would require a liquid-solid separation processes to recover the precipitated metals for shipment to an approved disposal site.

As of this time CST has not implemented its formal marketing program. Corporate marketing objectives focus on rapid penetration of the market to obtain market share and reinvestment in continued Research and Development to remain on the leading edge of treatment technology. We believe the window to achieve near-term market share in this emerging marketplace is very dynamic. As time passes the market growth will levelize as new competitors launch intense efforts to develop competing technologies. This is particularly true as it relates to Superfund Sites where development of alternative technologies is actively supported by very large companies and financed with Federal Government funding. Achieving rapid market penetration goals presents an ambitious implementation objective but presents the most viable opportunity for sustaining long-term growth.

In 1990 CST produced net income of \$64,528 on revenues of \$414,510. For the six month period ending June 30, 1991, CST has net income of \$9,733 on revenues of \$189,665. The substantial decline in percentage of net income for the most recent period is the result of expenditures made in expanded engineering and marketing activities.

CST has compiled a ten year financial forecast, including forecasted balance sheets, statements of earnings, retained earnings and cash flows for the period ending in the year 2000. These forecasts were developed in accordance with standards established by the American Institute of Certified Public Accountants. Appropriate market and sales assumptions are described in detail in the forecast. Based on conservative projections it appears the Company could achieve annual revenues and net income of \$124 million and \$12 million by 1995 and \$523 million and \$53 million respectively by the year 2000. It is essential to note that as project unit financing is amortized, cash flows generation improves significantly. Another fundamental point which impacts net income and requires mention, is the Company's focus on reinvestment of cash flow in Research and Development. Details supporting these financial forecast results are contained in the body of this document.

CST's immediate goal is to focus on market development and accelerated financial growth. As an emerging company it recognizes the magnitude of the impending challenge to attain this goal. To achieve the accelerated expectations, there is compelling evidence of the need to align its operations with a cooperative entity possessing a substantial financial and synergistic infrastructure. While CST remains

flexible in analyzing various approaches, we continue to believe the most solid framework for implementing mutually beneficial objectives, is by offering an equity position to an entity which has compatible characteristics. These positive attributes would include: visionary and aggressive attitude surrounding business approach; skill sets which compliment the elements where CST requires enhancement; and the financial strength to make a substantial capital investment. Business experience indicates the probability for success improves dramatically when all participants have a vested equity interest and are committed to the future success of the company.

We believe CST has an extremely bright future in the environmental water treatment business. The initial response to our technology and business approach has been exceedingly positive. Our primary objective is to establish a financial and operational infrastructure relationship which is commensurate with our aggressive strategic plan. This will provide the Company the ability to quickly become a proactive force in the environmental water treatment marketplace.

CONFIDENTIALITY AGREEMENT

Copy No. _____ provided to _____.

Confidentiality of Information - This prospectus document is for your confidential use only. It is being submitted to prospective investor or shareholders of Chemical Separation Technology, Inc., solely for your confidential use, with the express understanding that, without the prior written permission of Chemical Separation Technology, Inc., you will not release this document or discuss the information contained herein or make reproductions of or use this document for any purpose other than evaluating the potential opportunity associated with becoming an investor or shareholder in the Company.

A prospective investor or shareholder, by accepting delivery of this document, agrees to promptly return to Chemical Separation Technology, Inc., this document and any other documents or information furnished if the prospective investor or shareholder does not elect to become a contributing investor or shareholder in Chemical Separation Technology, Inc.

The confidentiality agreement on the following pages is intended to be a mutually beneficial and protective instrument. This agreement will bind both signatory parties to keep confidential the sensitive technical and business information of the other. The purpose of this agreement is to allow the free exchange of information which could be used to conclude a mutually cooperative business relationship.

CONFIDENTIALITY AGREEMENT

THIS AGREEMENT is entered into this ____ day of June, 1991, by and between CHEMICAL SEPARATION TECHNOLOGY, INC. (hereinafter "CST"), having an office at 9817 N.E. 54th Street, Suite 101, Vancouver, Washington 98662, and _____ (hereinafter "_____"), having an office at _____.

WHEREAS, CST, and _____ may desire to enter into negotiations for a possible joint cooperative relationship for the utilization of CST technology and to negotiate various business ventures between CST and _____; and

WHEREAS, during these negotiations, each party will be exposed to proprietary information, including technology and business plans of the other party; and

WHEREAS, each party desires to enter into this agreement for the protection of its inventions, proprietary information and business plans from disclosure or use by the other party;

NOW, THEREFORE, in consideration of the premises and for the purposes of facilitating the negotiations, CST and _____, each corporation, employees, agents and assigns, agree as follows:

A. During the term of all negotiations and for a period of five (5) years after the conclusion of negotiations between CST and _____ each party shall keep confidential and refrain from using or disclosing to others all technological information, proprietary information, trade secrets and business plans of the other party that is acquired or learned in the course of negotiations between the parties. All written information shall be clearly marked proprietary by the owning party. All confidential conversations shall be described as such by the owning party.

B. This nondisclosure obligation is not intended to prevent either party from making disclosures required by applicable law or by the order of any court having jurisdiction; provided, however, that a party intending to make a disclosure required by law or by a court order shall use its best efforts to provide to the other party reasonable written notice of such intent prior to disclosure and to cooperate with the lawful efforts of the other party to oppose or resist such disclosure.

C. Upon termination of negotiations, and whether or not a joint venture or other agreement is reached by the parties, each party shall return to the other all documents, records, notebooks and other sources containing the other party's Proprietary Information.

D. If a party to this Agreement believes that information claimed to be confidential under this Agreement by the other party is not in fact confidential, it shall notify the other party and, prior to disclosure, shall meet with the other party and discuss the confidential nature of the information.

E. No rights under this Agreement shall be assigned or transferred by either party without the written consent of the other party.

F. No governmental agency or private party, including any subcontractors, is intended to be a third party beneficiary of any rights or obligations under this Agreement.

G. This Agreement shall be construed under the laws of the State of Idaho. Exclusive venue for any claims arising under this Agreement shall be in the appropriate court in Boise, Idaho.

H. Each party acknowledges that disclosure of Proprietary Information would cause irreparable harm to the other party, and agrees that the obligations of this Agreement may be enforced by an injunction or order of specific performance, and that a party harmed by such disclosure shall be entitled to damages and all other remedies allowed by law.

I. The terms of this Confidentiality Agreement shall be considered to be a part of each and every agreement that may be entered into between the parties unless expressly waived by the parties.

CHEMICAL SEPARATION
TECHNOLOGY, INC.

By _____

Its _____

By _____

Its _____

STATE OF _____)
County of _____) ss.

On this _____ day of _____, 19 _____, before me, the undersigned, a Notary Public in and for the State of _____, duly commissioned and sworn, personally appeared _____, known to me to be the _____ of CHEMICAL SEPARATION TECHNOLOGY, INC., the corporation that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath state that he is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal hereto affixed the day and year in this certificate above written.

Notary Public in and for
the State of: _____
Residing at: _____
My Commission expires: _____

STATE OF _____)
County of _____) ss.

On this _____ day of _____, 19 _____, before me, the undersigned, a Notary Public in and for the State of _____, duly commissioned and sworn, personally appeared _____, known to me to be the _____ of _____, the corporation that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath state that he is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal hereto affixed the day and year in this certificate above written.

Notary Public in and for
the State of: _____
Residing at: _____
My Commission expires: _____

INTRODUCTION

What is CST

Chemical Separation Technology, Incorporated (CST) is an Idaho Corporation with offices located in Vancouver, Washington, and Pittsburgh, Pennsylvania. CST provides high-tech acid neutralization and waste water treatment services to utility companies and the metals and coal mining industry. The Company installs its treatment units on clients sites to process acidic discharge contaminated with metals suspended in solution. The patented treatment units feature computer controlled caustic neutralization in a specially designed reactor vessel. The portable units are easily moved which is especially attractive for remote discharge and seepage locations. Larger units are installed in either temporary or permanent facilities. The process treatment produces an effluent which meets EPA discharge standards. Site hydrologic characterization, waste water testing and process design engineering services are also offered by the company.

Mission Statement and Goals

The CST mission is to resolve environmental discharge problems for clients by providing price competitive treatment services which will allow them to achieve regulatory compliance and environmental recognition.

To implement the Company's Mission Statement our operative goals are as follows:

- o Provide safe, efficient and cost effective services which fully satisfies customer requirements
- o Focus near term efforts on rapid market penetration in the utility, coal mining and metals mining industries which will gain a significant market share in this emerging marketplace.
- o Position the Company to achieve continued growth through research and development into new market applications for the CST process.
- o Execute business activities in a profitable manner which will promote the financial health of the Company, provide a stable work environment for employees and maximize return on investment for shareholders.
- o Become a recognized environmental leader and respected corporate citizen through the development of "Innovative Environmental Technologies".

Corporate Structure

Chemical Separation Technology, Inc. (CST) is an Idaho Corporation partly owned by Group West Corporation of Vancouver, Washington and POWER Engineers of Hailey, Idaho. Additionally, there are five individual shareholders who hold equity positions in the Company. The Company was acquired in December, 1990 from the original founders in Pittsburgh, Pennsylvania. An organizational chart showing the current ownership and responsibilities is presented in FIGURE 1 on the following page.

Personnel Summaries

CST principals have broad experience in organization, planning, management, operations, engineering and financial matters. Additionally, we have expertise, understanding and contact networks in the mining and utility industries. The following are brief personal summaries of the professionals who are the core strength of CST's business expertise.

- o Steven L. Thorson, President - Mr. Thorson's extensive business management and consulting expertise includes experience in utility companies, government agencies and private industry. His consulting knowledge and experience includes direct applications in the following areas: strategic planning; management audits and analysis; organizational restructuring; reorganization advisory counseling; operations improvement; and financial forecasting, budgeting and analysis. Mr. Thorson has developed and implemented a number of computerized models which analyze and forecast appropriate management methodologies in replacement analysis, budgeting, financing, resource allocation and merger/acquisitions. He was formerly a Senior Management Consultant with the firm of Deloitte & Touche. His business activities and consulting assignments have provided him a broad knowledge and understanding of the utility industry and afforded him the opportunity to achieve a strong personal network within the industry. Mr. Thorson holds a Bachelor of Science Degree in Finance from the University of Utah.
- o Russell P. Wischow, Director - Dr. Wischow has been responsible for the development and construction of utility power generation projects and operation and maintenance of major non-regulated independent power projects. Most recently he was the President and CEO of PG&E Operating Services, a non-regulated subsidiary of Pacific Gas and Electric Company which provided operating and maintenance services to the independent power industry. He was the first Director of the USAEC Division of Nuclear Materials Safeguards and was Director of

research and Development for a spent nuclear fuels reprocessing plant which managed the International Atomic Energy Agency sponsored program to develop international inspection of nuclear fuels reprocessing plants. He is a member of various professional societies, holds several patents and has presented papers at national meetings. Dr. Wischow holds a PhD in Chemistry from Vanderbilt University.

- o S. M. Stevenson, Vice President Operations - Mr. Stevenson has twenty eight years of highly diversified experience in the industrial and commercial sector. He is highly qualified in administrative and project management, design and construction coordination and has strong educational background and experience in all levels of management. He is one of the original founders of CST and was instrumental in development of the technology and the CST patent.
- o John J. LeFever, Project Manager - Mr. LeFever is a minerals engineer with 14 years of experience in mine design, engineering geology, projects evaluation, engineering development, and exploration of precious metals, base metals, oil shale, coal, lignite, and salt. As a project manager, he has experience in project budgeting, control and accounting, policy and personnel, as well as in taking a new project from raw prospect through the phases of financial justification and board approval, mining and geological evaluation, detailed engineering, development, and permit approval. Mr. LeFever's background includes six years of experience in computerized geostatistical analysis, ore reserve estimation, mine planning, and cost estimating of open pit precious metals deposits. Mr. LeFever holds a B.S. degree in Geological Engineering from Montana Tech.

Description of Process

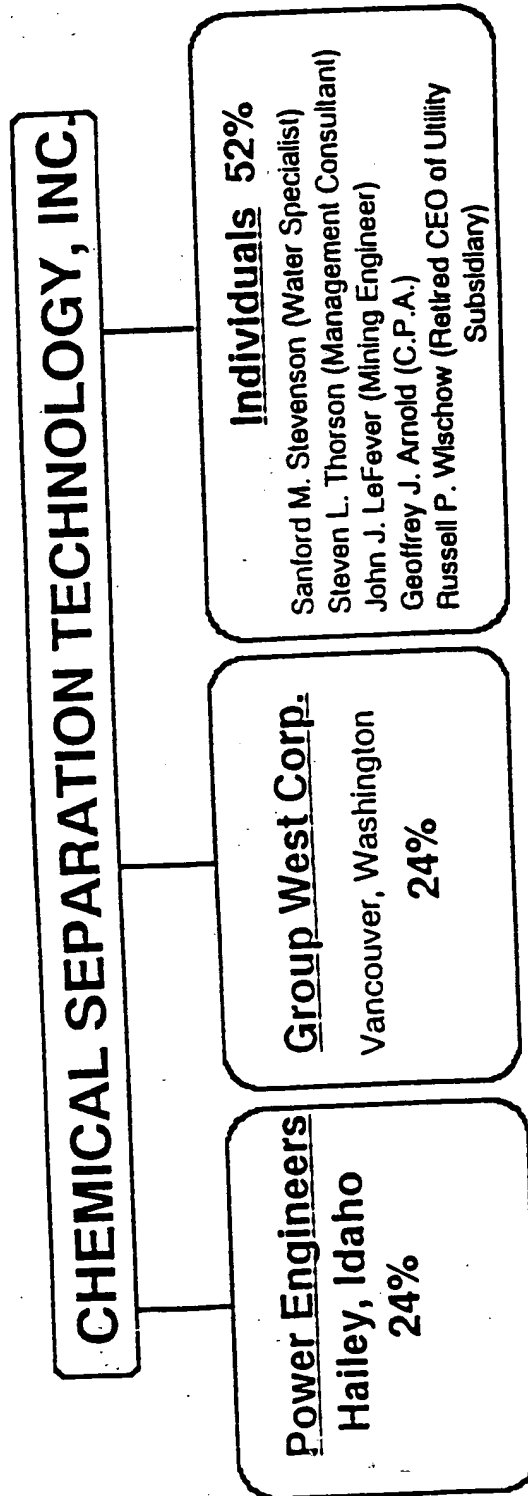
The CST process is currently used to treat leachates in commercial operations at a coal-fired power plant ash disposal site and a coal refuse site in Western Pennsylvania. Sodium hydroxide and oxygen are combined with the leachate in a patented reactor to precipitate metals and neutralize acid. Liquid-solid separation processes are included at the power plant site to recover the precipitated metals for disposal. The CST process differs from other waste water treatment systems in that air, which is continuously drawn into the reactor in the form of very fine bubbles, and concentrated sodium hydroxide, are mixed simultaneously to create localized pockets of high oxygen concentration and alkalinity. The net effect of this design is an acceleration in the oxidation and precipitation rates which are considerably higher than those achieved by conventional mechanical agitated, lime-based processes. Through the use of state-of-the-art computerized process control instrumentation, the pH can be held at a constant

level allowing point precipitation of metals in solution. Reactants other than sodium hydroxide and oxygen, such as soda ash, permanganate, hypochlorite, peroxide and ozone can be incorporated in the CST process for specific removal of contaminants. The CST process is far less capital intensive than the traditional lime treatment plants. Additionally, our process does not create substantial material handling problems inherent with the creation of vast amounts of gypsum in lime-based systems.

CST Service Business Concept

CST's core business focus is to operate as a turnkey water treatment service company. We do not intend to market our patented equipment as a manufacturer, but rather implement, own and operate the plants as a water treatment service which specifically addresses each client's particular environmental discharge problems. This business strategy will allow CST to protect its technology from potential patent infringement in the near term and provide the framework for long term profitability as project financing is amortized and continued revenues become a profit contribution. This is fundamentally a different approach from that offered by our competition, which generally prescribes a traditional engineering approach requiring construction of capital intensive lime treatment facilities. We have received a positive response to our service business approach from clients who require contaminated water treatment. The concept of a client being able to solve significant discharge problems without a considerable up front capital expenditure is very attractive.

Relationship of Affiliated Companies and Ownership Structure of
Chemical Separation Technology, Inc.



is owned by:

FIGURE 1

Functional Relationship

CST - Provides high tech waste water
treatment of acid mine drainage.

Group West - Provides management
planning and financial expertise.

Power Engineers - Provides engineering
expertise and construction
management.

TECHNICAL DESCRIPTION

Detail Description of Process

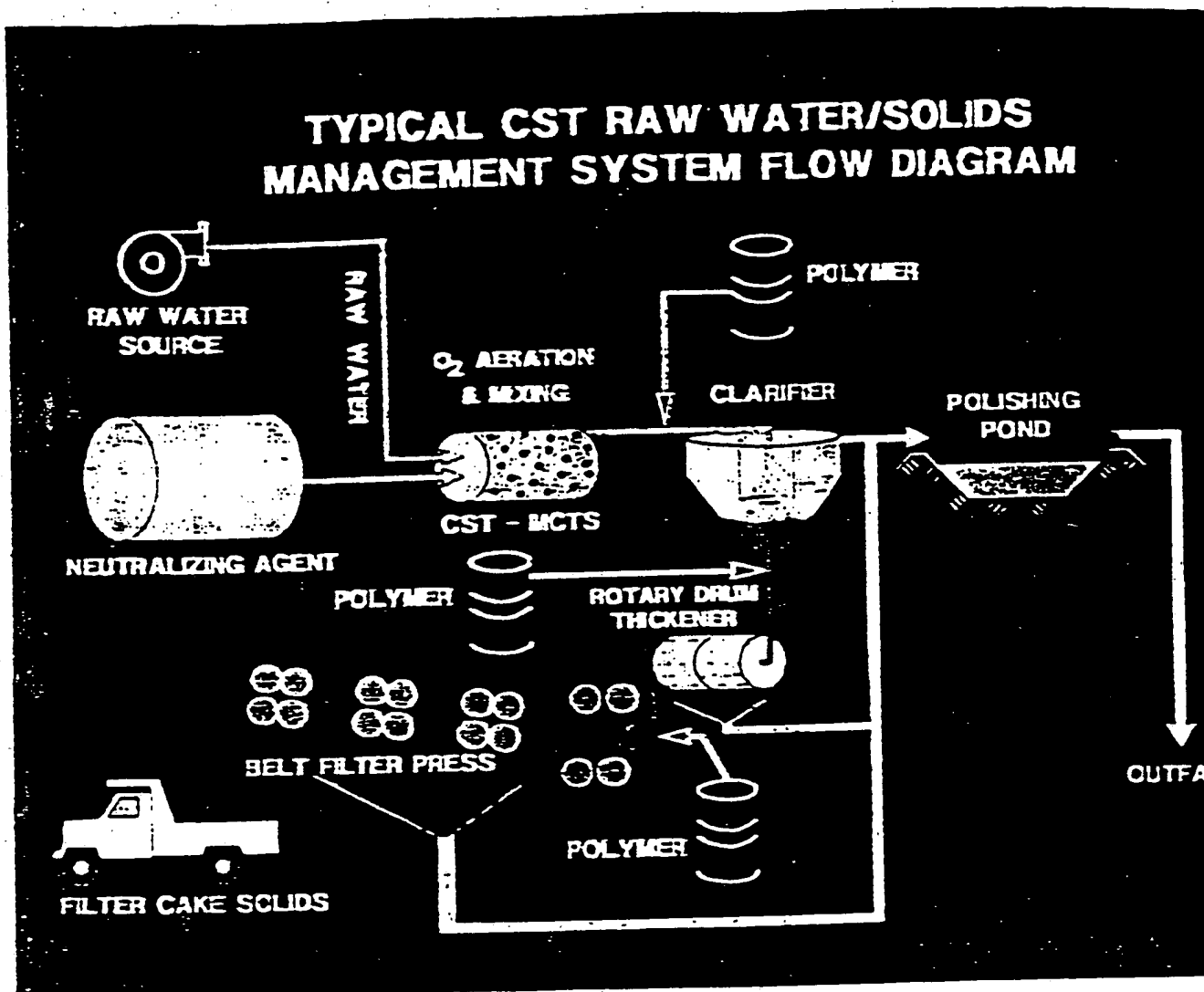
An increasing concern for the quality of the water released to the environment led to the development of the patented CST process and equipment. Acidic and metals-bearing effluents from coal and metals mines and from coal-fired utility power plant coal and flyash deposits will severely degrade streams, rivers or lakes unless remedial actions are taken. The currently proposed Clean Water Act Reauthorization Bills before Congress will mandate corrective actions and potentially increase civil and criminal penalties for non-compliance with the Clean Water Act standards.

The equipment is comprised of a cylindrical reaction vessel with internal baffles, computer-controlled pH monitoring and recording equipment, an aeration motor, piping and chemical storage tanks. Sludge thickening, dewatering and filtration equipment or clarifiers reduces the solid wastes to the minimal volume for efficient disposal. The equipment is easily scaled to handle the volume flowrate of the individual problem, ranging from as small as ten gallons per minute to major flows of 10,000 gallons per minute. Larger flows can be handled with multiple units to the flowrates required. The CST reactor and ancillary equipment is portable, either with skid-mounted or on flatbed trailers, for the flowrates from ten to 500 gallons per minute; permanent equipment can be installed either within buildings or outside, depending upon the individual requirements.

The CST process shown in FIGURE 2 on the following page, receives acidic leachate from coal, flyash or metals mines containing metallic constituents which are fed to the CST reactor where sodium hydroxide is simultaneously and vigorously mixed with air to create localized high concentrations of neutralizing and oxidizing conditions. As a result, the reaction times are markedly reduced, thereby eliminating large settling ponds and level areas which are generally not available, particularly in mountainous areas. Through the use of state-of-the-art computerized process control instrumentation, the pH is held at a constant level allowing the point precipitation of the metals in solution. The CST process is much less capital intensive than the traditional lime treatment plants and does not create substantial waste disposal problems that are inherent with the disposal of vast amounts of un-reacted lime with solids from the lime-based systems.

Acidic leachate of about 230 gallons per minute from an eastern coal-fired power plant flyash disposal site is being treated with a CST facility to provide water effluents meeting EPA standards for release to surface waters and a sludge that is suitable for disposal in the utility's disposal field. TABLE 1 illustrates the results that are routinely achieved. Although the water is not immediately suitable for drinking purposes, it is acceptable for industrial use or discharge to the local watershed. Greater than 99% of the iron and 94% of the manganese are precipitated in less than ten minutes at a routine pH of 7 to 8.

FIGURE 2



ADVANTAGES OF THE CST SYSTEM

Effective and Efficient

- Rapid Precipitation
- Instantaneous Reaction
- Precise pH Control
- Optimum Use of Chemicals
- Measurable and Documented Results
- Constant System Monitoring and Reporting
- Monitored and Controlled Remotely
- Meets All EPA NPDES Discharge Regulations

Sensible and Economical

- Modular System Construction—Quick Installation
- Service Contract
 - No Capital Investment
 - No Labor Problems
- Small Site Area Required
- No Multiple, Large Holding Basins
- Efficient Sludge Removal and Disposal

Flocculation, dewatering and belt-filtration recovers about 15,000 pounds of solids per day. The facility is sized so that it can routinely accept and process higher level excursions of acid and metal concentrations up to about 6000 and 7000 mg/liter, respectively. Combining the specific plant process designs with instrumentation controls, provides the CST process with a wide range of flexibility to handle changing flow rates, pH balance, contained metals and acidity levels.

TABLE 1. Western Pennsylvania Water Quality Data for January 28, 1991

	<u>Leachate</u>	<u>Effluent</u>	<u>Percent Removal</u>
Flow, US gpm	230		—
pH	2.9	7.1	—
Iron, mg/l	1,687	<1	99.9
Manganese, mg/l	17	<1	94.0
Aluminum, mg/l	114	17	85.0
Acidity, mg CO ₃ /l	4,040	0	—
TSS, mg/l	1,870	12	—

Further reduction in the aluminum and other trace metals such as a copper, zinc, lead and magnesium is achievable by controlled pH and oxidation modifications using the CST process. Other treatment steps, including lime-soda ash softening (to meet hardness requirements), removal of organics (by carbon adsorption), turbidity control (by coagulation and filtration), and disinfection (by chlorination), can be added to improve water quality that will potentially comply with drinking water standards.

Patent Discussion

The CST Patent (United States Patent Number 4,749,497) provides a new method to treat acidic and metals-contaminated leachates from utility plants, coal mines and metals mines which produces treated water that meets EPA Standards for discharge to the environment. The contained metals are precipitated and dewatered to permit discharge to approved disposal sites or for recycle of the contained metals. This unique process develops a continuous stream, mobile treatment system that can economically treat flows from 10 to 1,000 GPM, or when grouped from 1,000 to 10,000 GPM. The combination of reaction geometry and control systems establish the optimum point of mix, neutralization chemical and oxidant addition to achieve a one to one stoichiometric reaction. The Proportional Integral Differential (PID) control system continuously reads the chemical reaction pH, which allows execution of precise, instantaneous control over pH fluctuations in a very narrow band. Radio and telephone telemetry monitors required fail safe points in the process which allows the system to be operated remotely without the need for continuous on-site labor support. Additional down

stream processes have been developed and tested which separate and dewater oxide metals to 15% dry solids. Process patents for this advanced technology are being applied for at the present time. A copy of the patent document is provided in the Appendix section of this document.

Competitive Processes

Processes which focus on the addition of lime have been the conventional treatment of industrial acidic streams and discharge sources. Addition of lime or lime-sodium carbonate increases the pH and the resultant slurry is mixed to promote neutralization and oxidation. Generally, such treatment facilities are very capital intensive, utilizing complex mixing, lime slaking, and other labor intensive equipment. This process requires large settling basins or ponds to permit the mixing and slow precipitation to occur. Control of pH with lime depends on the extent of solid-liquid mixing and the reactivity of the lime which is a function of particle size, slaking, and the interference of calcium carbonate formed by the absorption of carbon dioxide. Lime processes provide only a high pH range in that a pH near neutral cannot be maintained with the solid-liquid reaction of lime with water. Solids from lime processes include the precipitated metals, but also large quantities of un-reacted lime which requires extensive material handling requirements.

Sodium hydroxide is not generally used to neutralize acid and precipitate metals in a traditional "lime-type" treatment process. This is because it retains most of the disadvantages inherent in the process such as high capital cost and the requirement for large solids settling basins. While the chemistry is not new, other processes using sodium hydroxide have not been commercially demonstrated or perfected like the CST process which is in full commercial operation. Competition from emerging technologies could increase as CST successfully penetrates the marketplace and generally increases its market share.

Compliance with EPA Discharge Standards

An increasing concern for the quality of the water released to the environment led to the development of the patented CST process and equipment. Acidic and metals-bearing leachates from coal and metals mines and from coal-fired utility power plant coal and flyash deposits will severely degrade streams, rivers or lakes with iron, manganese and acids unless remedial actions are taken. The currently proposed Clean Water Act Reauthorization Bills before Congress will mandate corrective actions and potentially increase civil and criminal penalties for non-compliance with the Clean Water Act Standards.

The CST process fully meets the EPA standards for discharge of industrial water to the environment. Current Pennsylvania discharge standards for iron and manganese are 4 ppm and 2 ppm, respectively with a pH range of 6 to 8. The CST treated water contains less than 1 ppm of either iron or manganese and has a pH range of 7 to 7.5. Other states are developing discharge standards which are expected to be similar to Pennsylvania for industrial water and follow EPA standards for drinking water.

Significant Provisions Clean Water Act

Senate Bill 1081 and House Bills 2029, 1330, 251, 404, and 2400, if authorized, would result in more restrictive effluent limitations and will require more extensive pollution prevention efforts. Key aspects of these bills would:

- o Require applications of the "Best Available Control Technology (BACT or BAT) to all pollutants.
- o Require sources to utilize techniques for pollution prevention and waste reduction.
- o Prohibit or limit the release of pollutants to environmental media, including ground water, to the extent such is economically and technologically feasible.
- o Require states to adopt administrative civil penalty provisions similar to the EPA under the Clean Water Act and increase civil and criminal penalties for noncompliance. Mandatory environmental audits would be required prior to permit renewals.

In The United States Court of Federal Claims

No. 97-21C

(Filed: September 26, 2003)

COPY

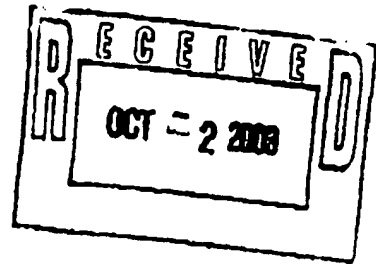
CHEMICAL SEPARATION
TECHNOLOGY, INC., et al.,

Plaintiffs,

v.

THE UNITED STATES,

Defendant.

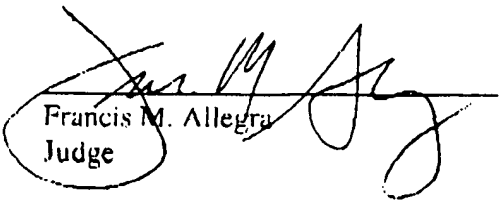


ORDER

On September 12, 2003, defendant filed an unopposed motion for enlargement of time for expert discovery. Defendant's motion is hereby **GRANTED**, and the schedule established by the court's July 3, 2003 order shall be modified as follows:

1. On or before November 12, 2003, the parties shall disclose expert reports in compliance with RCFC 26(a)(2)(B) of any expert who may be used at trial to present evidence on any remaining liability issues under Rules 702, 703, or 705 of the Federal Rules of Evidence (FRE), for which a party has the burden of proof at trial.
2. On or before January 2, 2004, the parties shall disclose expert reports in compliance with RCFC 26(a)(2)(B) of any expert who may be used at trial to present evidence on any remaining liability issues under Rules 702, 703, or 705 of the FRE, to rebut any expert testimony offered by a party that has the burden of proof at trial.
3. On or before February 2, 2004, any expert witness depositions shall take place.
4. On or before February 16, 2004, the parties shall submit a joint status report indicating how this case should proceed with, if appropriate, a proposed schedule for the filing of dispositive motions.

IT IS SO ORDERED.


Francis M. Allegra
Judge



Creation date: 12-20-2004
Indexing Officer: TMEKURIA - TADELE MEKURIA
Team: OIPEBackFileIndexing
Dossier: 09652272

Legal Date: 03-18-2004

No.	Docode	Number of pages
1	PRIA	4

Total number of pages: 4

Remarks:

Order of re-scan issued on